

NDIA's 59th Annual Fuze Conference

NAVY OVERVIEW



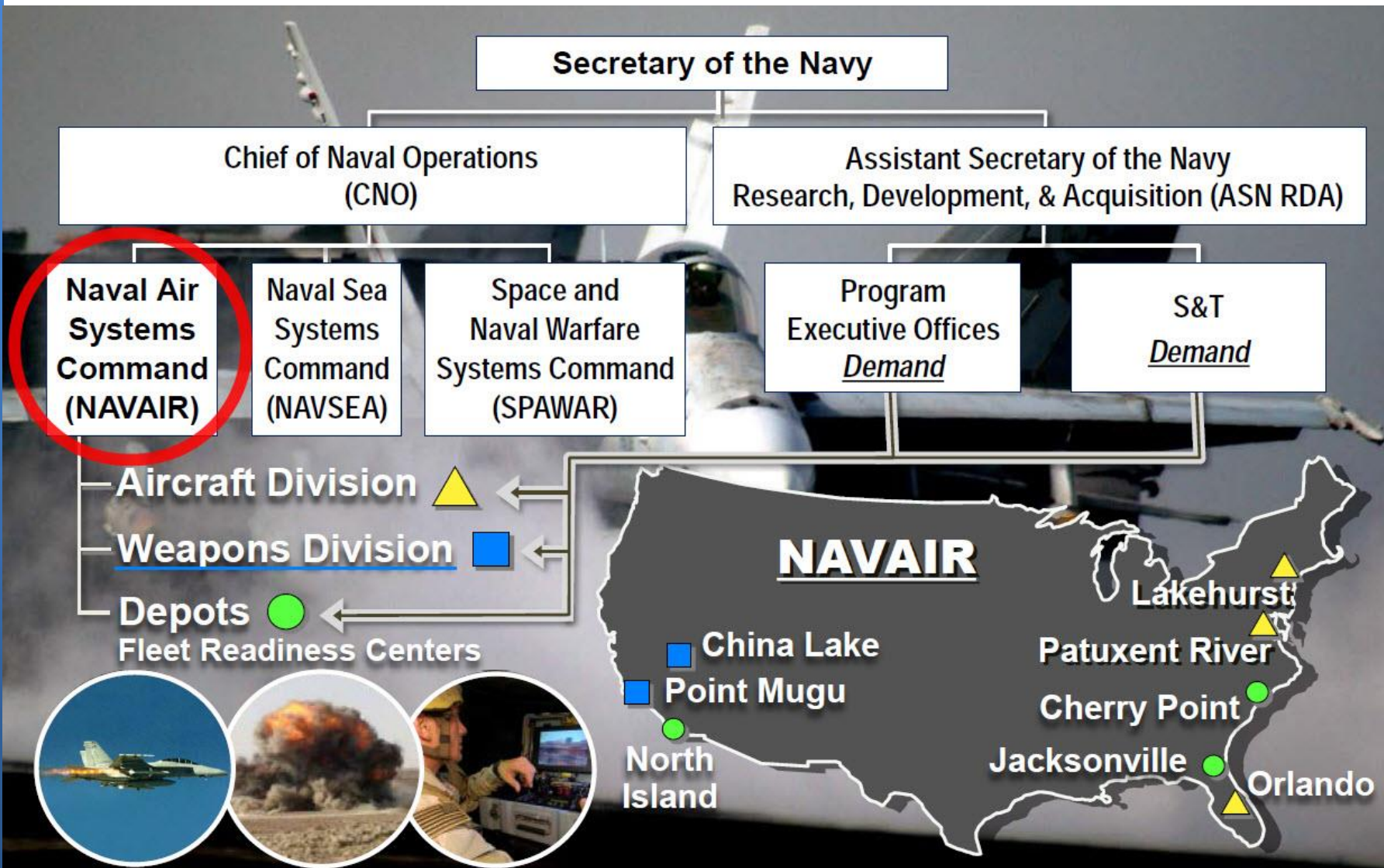
Charleston, SC
4 May 2016

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Outline

- Navy Organizations
- Navy Fuze Work Highlights
- FISTRP Overview
- Summary

NAVAIR Organizational Alignment



NAWC/WD Engineering Org Chart



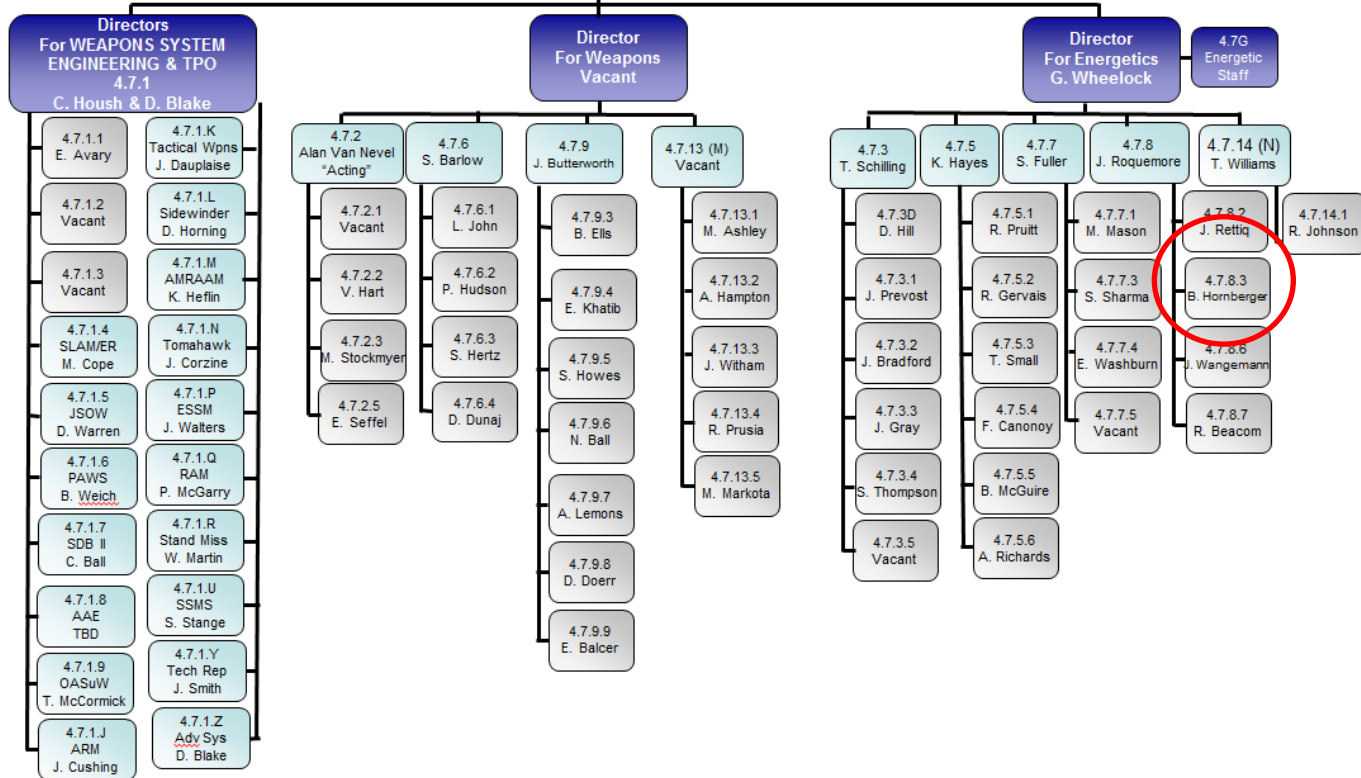
Rear Adm. Brian K. Corey
NAWCWD Commander

Capt. Karl Andlira
NAWCWD Vice Commander

Joan Johnson, SES
NAWCWD Executive Director
Director, Research and Engineering (4.0)

AIR 4.7 WEAPONS and ENERGETICS DEPARTMENT
Director, Mr. Daniel Carreño
Military Director, Commander Buus
Technical Director, Mr. Charles Bechtel
Director of Operations, Ms. Diana Sliva

4.7E
Chief Engineer Office
R. Kelly
R. Ligon
R. Schultz



Ogden, Utah: 20 civ.

- Co-located at Hill Air Force Base
- CAD / PAD Air Force Integrated Product Team

Indian Head, Md. (two sites): 1,572 civ., 1 mil. and 315 ctr.

- NAVSEA Center of Excellence (CoE) for Energetics
- DoD EOD program lead
 - Combined Explosives Exploitation Cell platoons



Picatinny, N.J.: 254 civ., 5 mil., and 15 ctr.

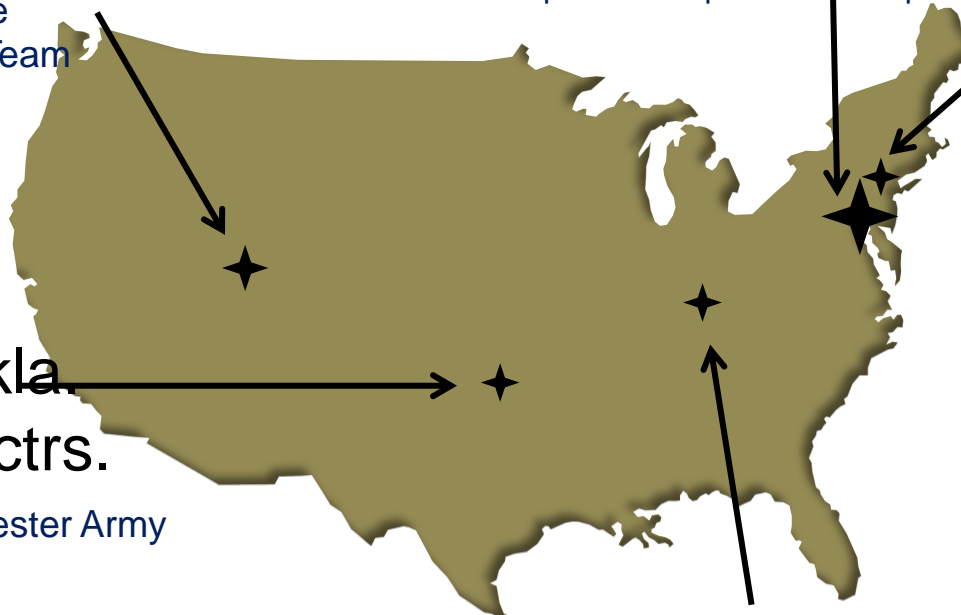
- Located at Picatinny Arsenal
 - Joint CoE for Guns and Ammo
- Navy Package, Handling, Storage and Transportation (PHST), Guns and Ammo

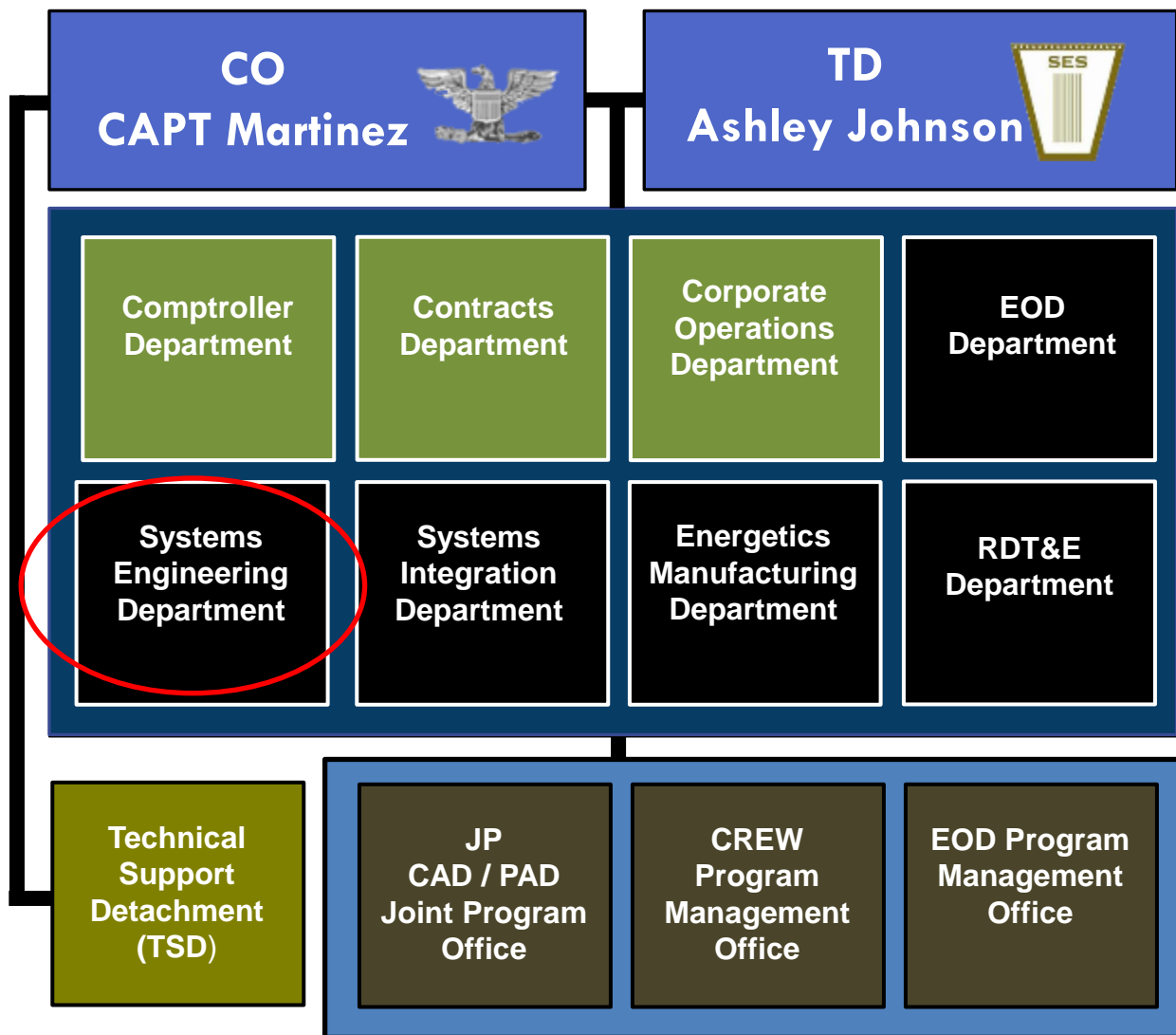
McAlester, Okla.: 24 civ. and 6 ctrs.

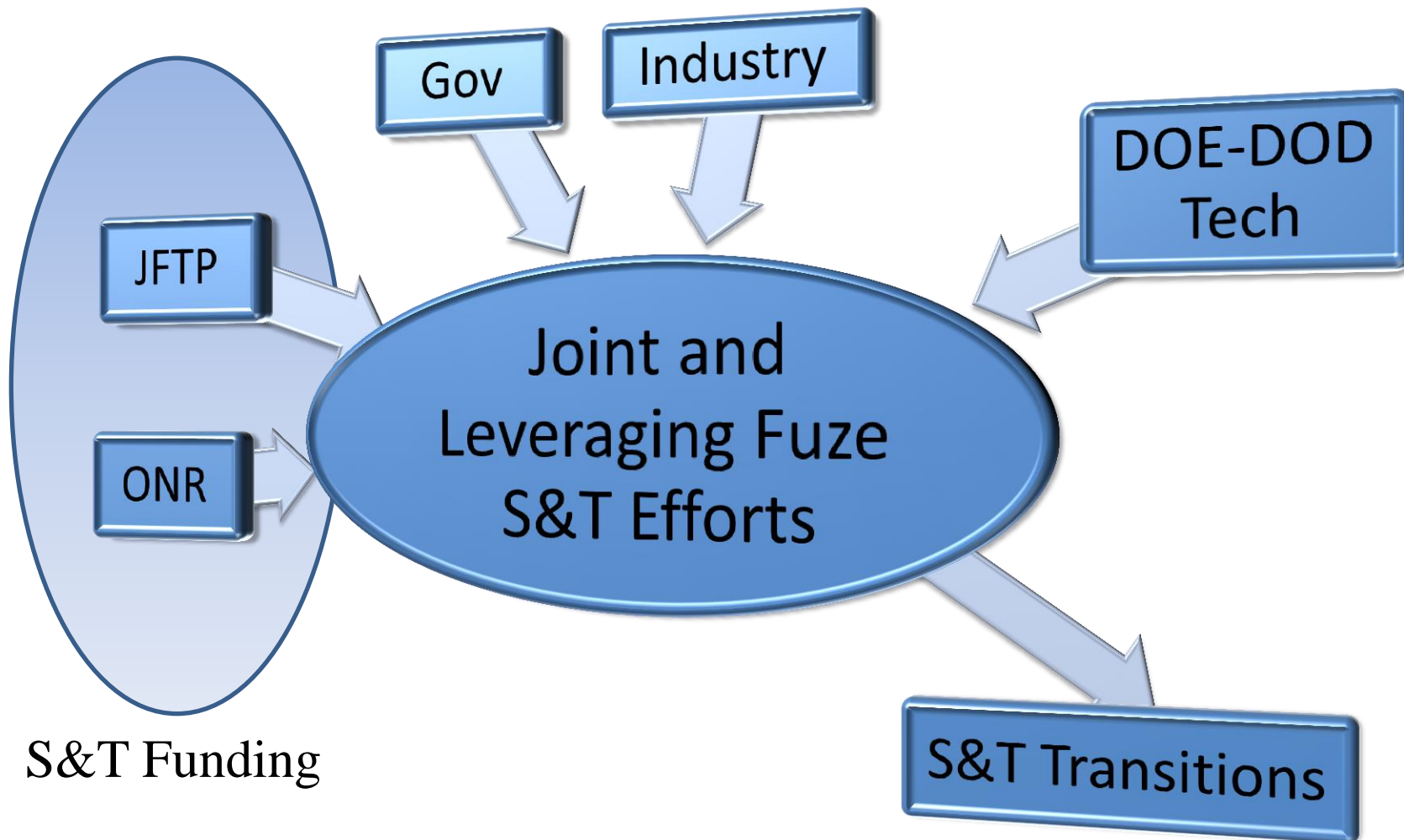
- Co-located at McAlester Army Ammunition Plant
- Navy Special Weapons

Louisville, Ky.: 12 civ. and 12 ctr.

- Naval Guns

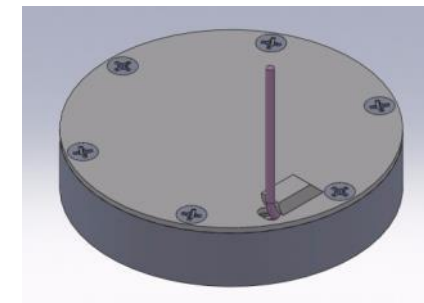
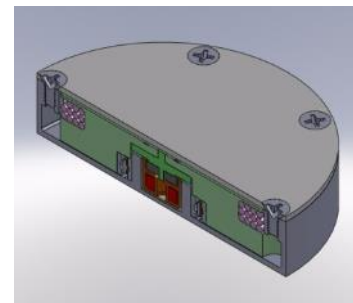
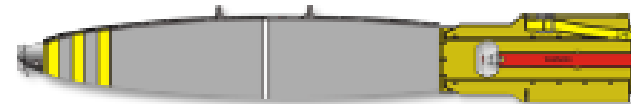






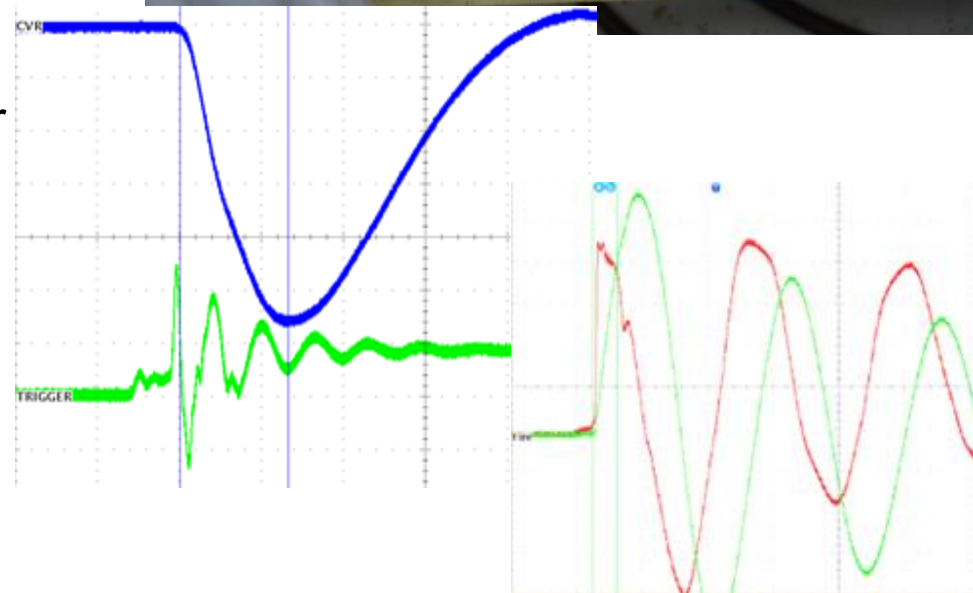
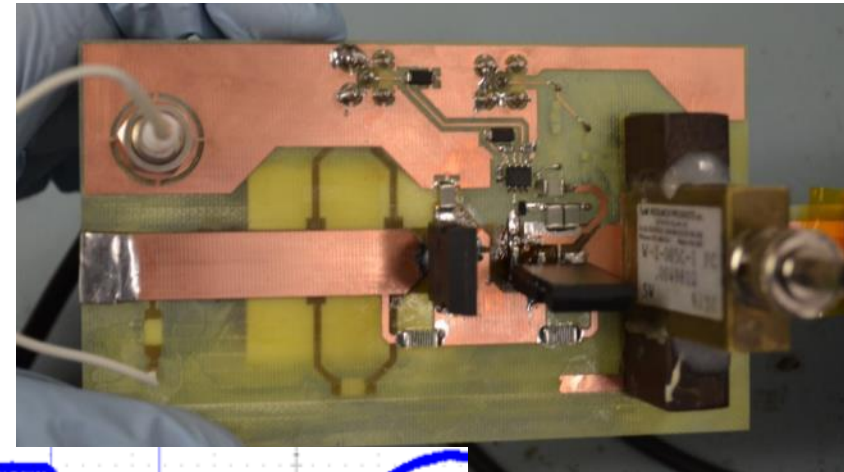
- ONR: High Reliability DPICM Replacement (HRDR), Hyper Velocity Projectile Fuze
- Joint Fuze Technology Program (JFTP) - Navy Projects Briefed at Conference:
 - DoD MEMS Fuze Reliability Evaluation (Session IVA)
 - High Reliability DPICM Replacement (HRDR) (Session IIIB)
 - Metal Free Primary Explosives for MEMS Detonators (Session VB)
 - Energy Harvesting for ESAF in Gravity Dropped Weapons (Session IIIB)
 - Stacked MOSFET in IGBT Pulse Discharge Switch (Session VB)
 - MEMS Impact and Retard Sensors (Session VA)
 - Unpowered Validation of Setback, Cannon and Railgun (Session IIIB)
- JFTP – Additional Navy Projects & Involvement:
 - Advance Proximity Sensing
 - Hard Target Survivability – Modeling & Simulation, Testing, Encapsulation, Materials
 - DoD MEMS Fuze Reliability Evaluation
 - Metal Free Primary Explosives for MEMS

- Update on the development of the freefall energy-harvesting generator and event detector targeting future Gravity Dropped Weapon ESAF.
 - Lanyard pull energy-harvesting to power the fuze electronics and drop event detection
 - Two-environment drop event detection
 - Targeting application in general purpose bomb and future miniature munitions.



Closed Session IIIB briefing provided by Mr. Paul E. Anderson

- Demonstrating a novel pulse discharge switch topology based around a series stacked IGBT.
 - Built around COTS IGBTs
 - \$20-50 per switch
 - Achieved 500+ shots into 0.5Ω load, several shots into 0Ω load
 - Live Fire testing planned for later this year on prototype configuration
 - Packaging study planned for continuing FY16 effort
 - Targeting application in any ESAF

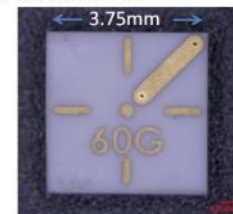


Closed Session VB briefing provided by Mr. Paul E. Anderson

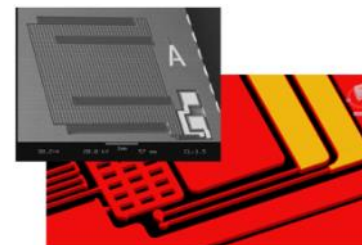
- Exploit existing MEMS micro-fabrication and packaging technologies to obtain higher-performance DoD retard and impact sensors.
- Improved G-sensor performance for existing and future fuzes.
- Two efforts – Metal(LIGA) and Silicon(DRIE).
- Small lots of both metal and silicon retard sensors have been fabricated by their respective microsystem manufacturers, and have been submitted to fuze vendor for evaluation.
- DOTC contract established with ATK to evaluate and qualify MEMS G-sensors.



Conventional Impact Sensor



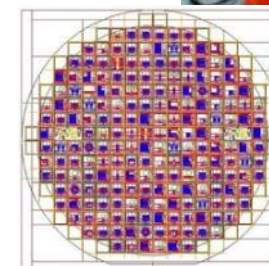
Metal (LIGA) Impact Switch



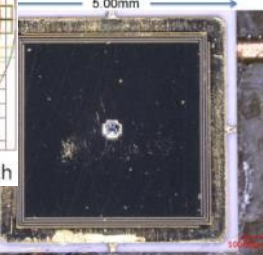
Silicon (DRIE) Retard Sensor



Metal (LIGA) Retard Sensor



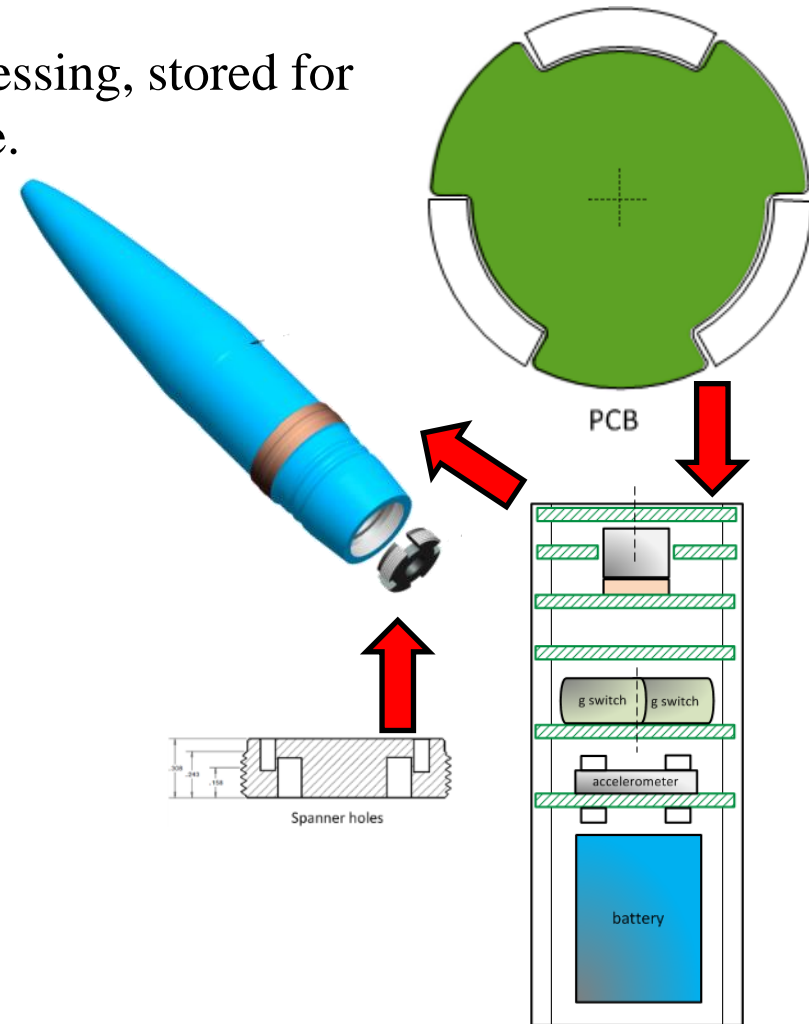
Silicon (DRIE) Impact Switch



Closed Session VA Briefing provided by
Mr. Edward Cornell

Unpowered Validation of Setback, Cannon and Railgun

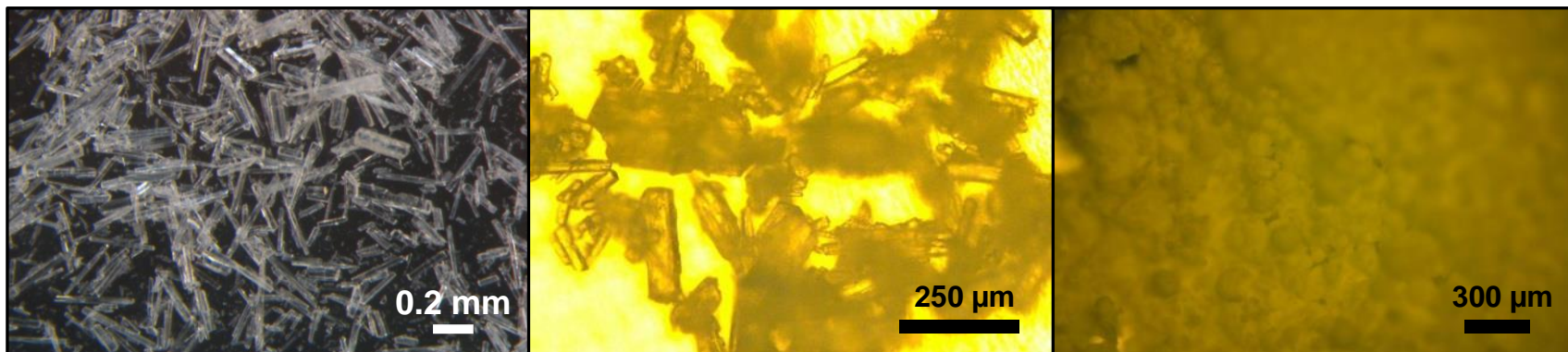
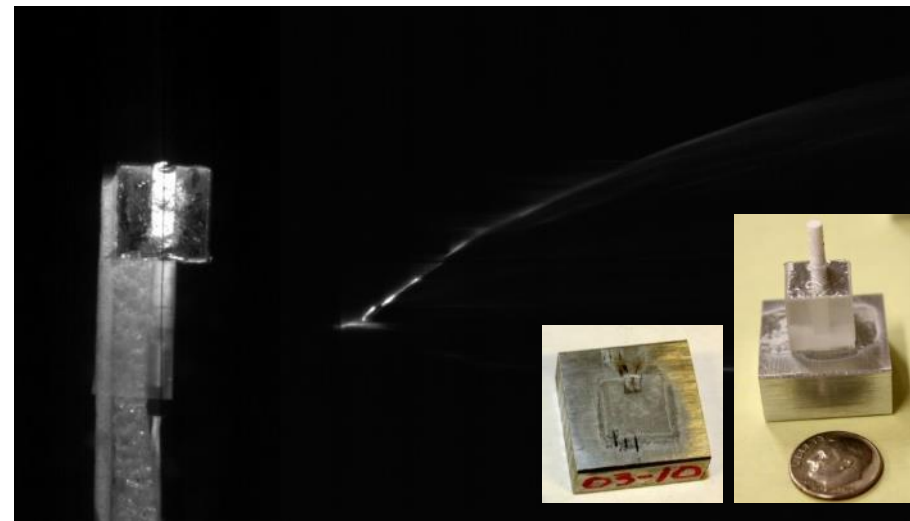
- Energy harvesting and analog signal processing, stored for later examination when power is available.
- Results of 40MM/L70 test Plan
 - Wednesday @ 16:40
- Magnitude and duration of setback
- No-spin to spin state change
- Customized data recorder
- Plan for Railgun firing



Closed Session IIIB briefing provided by Ms. Ketherine Harriger

Metal-free Primary Explosives for MEMS Detonators

- Develop metal-free, primary explosive with nitramine-like output and lead azide sensitivity for low-energy, out-of-line systems.
- Investigate and characterize CL-30, a novel high-output organic primary for MEMS devices.



Closed Session VB briefing provided by Mr. Andrew Ihnen



Technical Challenges

1. Increase submunition fuze and explosive train reliability to >99%
2. Develop multi-layer potting compounds to protect electronic/MEMS fuzes
3. Construct safety compliant, distributed fuzing architecture and power system

Underlying Science

- Physics based explosive transfer models and experiments
- Predicting and measuring material failure under acceleration
- Arming signal/power surety under very high spin rates

Capability Realized

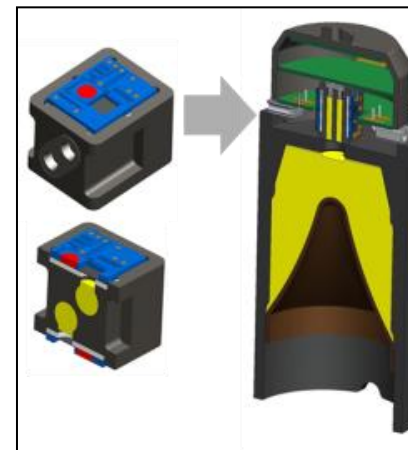
- Maintain area effectiveness of canon fired cluster munitions and meet OSD UXO Policy

Intellectual Property

- Navy Case number 102,421, "Distributed Fuze Architecture for Highly Reliable Submunitions"

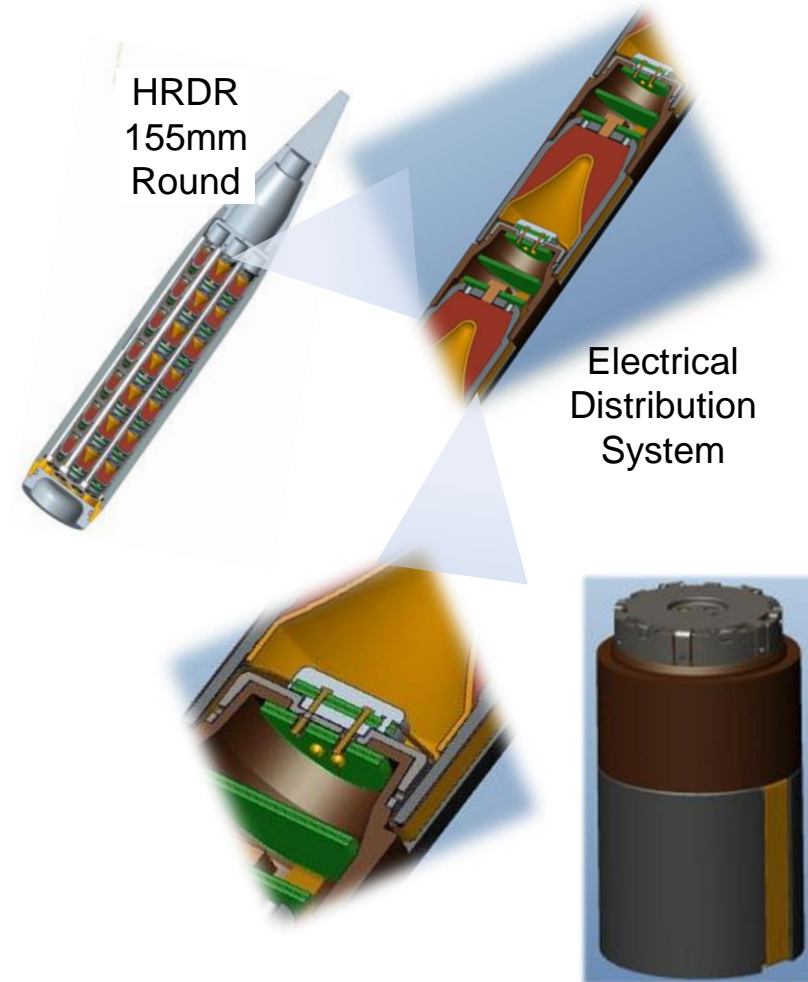
Investment Sources

- Office of Naval Research
 - Code 30
 - Future Naval Capability
- Joint Fuze Technology Program
 - FATG II, III and IV
- Naval Innovative Science and Engineering (219)



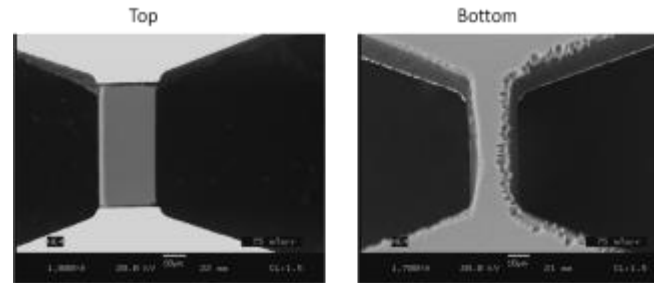


- Developing technologies to enable electrical signal distribution in a weapon system with large numbers of submunitions
 - Minimize disruption to the dispense event
 - Maintain robust mechanical and electrical interfaces

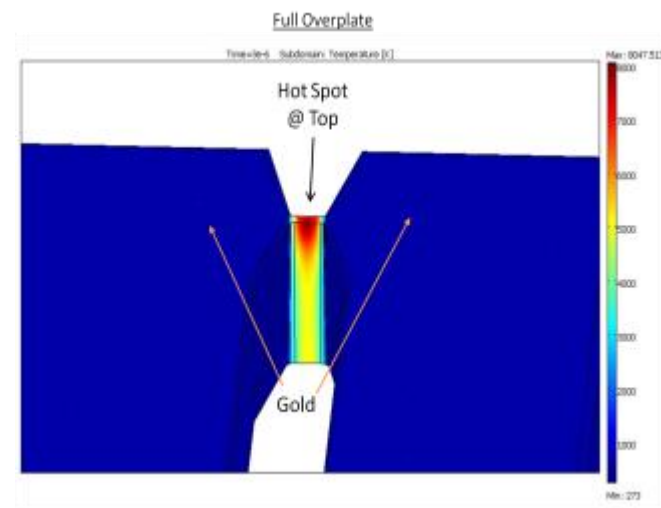


Closed Session IIIB briefing
provided by Kevin Cochran

- Produce calculated reliability predictions for MEMS based explosive trains
- Characterize shock initiation and material properties of EDF-11
- Combined analysis of (100+) test data sets to determine a reliability of MEMS explosive interface



Model Hot Spots

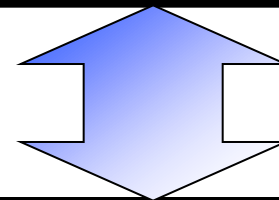
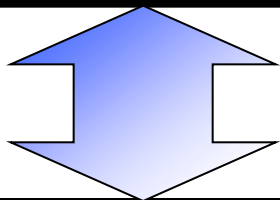


Open Session IVA briefing provided by Taylor Young

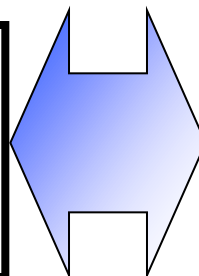
FISTRP Overview

Navy Fuze Safety Review Process

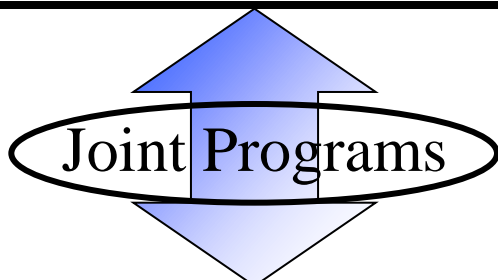
Weapon System Explosives Safety Review Board – WSESRB



Fuze Initiator System
Technical Review Panel
FISTRP



Software System Safety
Technical Review Panel
SSSTRP



Army Fuze Safety Review Board & Army
Ignition Systems Safety Review Board

AF Non Nuclear Weapons Safety Board



Fuze and Initiation Systems Technical Review Panel (FISTRP)



Panel Chair – Gabriel Soto

Panel Members –

Raymond Ash

Ralph Balestieri

Tinya Coles-Cieply

Michael Demmick

Bradley Hanna

John Hughes

John Kandell

Michael Haddon

Jason Koonts

Adedayo Oyelowo

Melissa Milani

Daniel Pines

Current Topics of Interest/Challenge

Environmental Qualification (e.g forty foot drop, etc)

Low Voltage Command Armed Devices

JOTPs

MIL-STD-1316

STANAG 4187

MIL-STD-1901

STANAG 4368

MIL-STD-1911

STANAG 4497



Summary

- **Navy R&D fuze activity focused on ESADs and MEMS**
- **Detailed, Navy centric briefs to follow as part of the 59th Fuze Conference**