SAND2020-7592 C

Advanced Fuzing Technology Sandia National Laboratories

ADVANCED FUZING TECHNOLOGY

PRESENTED BY

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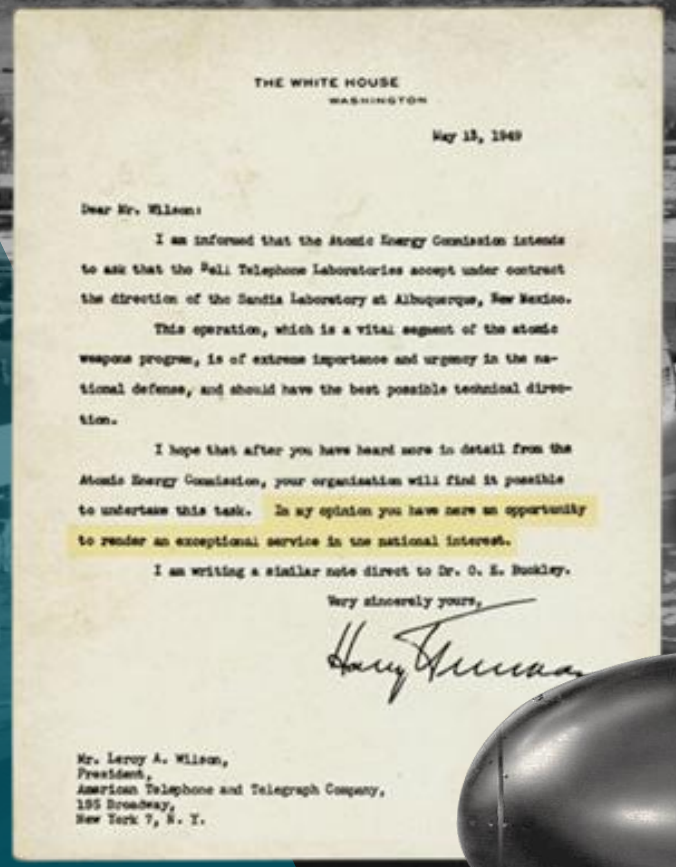
SANDIA'S HISTORY IS TRACED TO THE MANHATTAN PROJECT

…In my opinion you have here an opportunity to render an exceptional service in the national interest.

- July 1945
  Los Alamos creates Z Division
- Nonnuclear component engineering
- November 1, 1949
  Sandia Laboratory established
- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–2017
- Honeywell: 2017–present



THE WHITE HOUSE
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

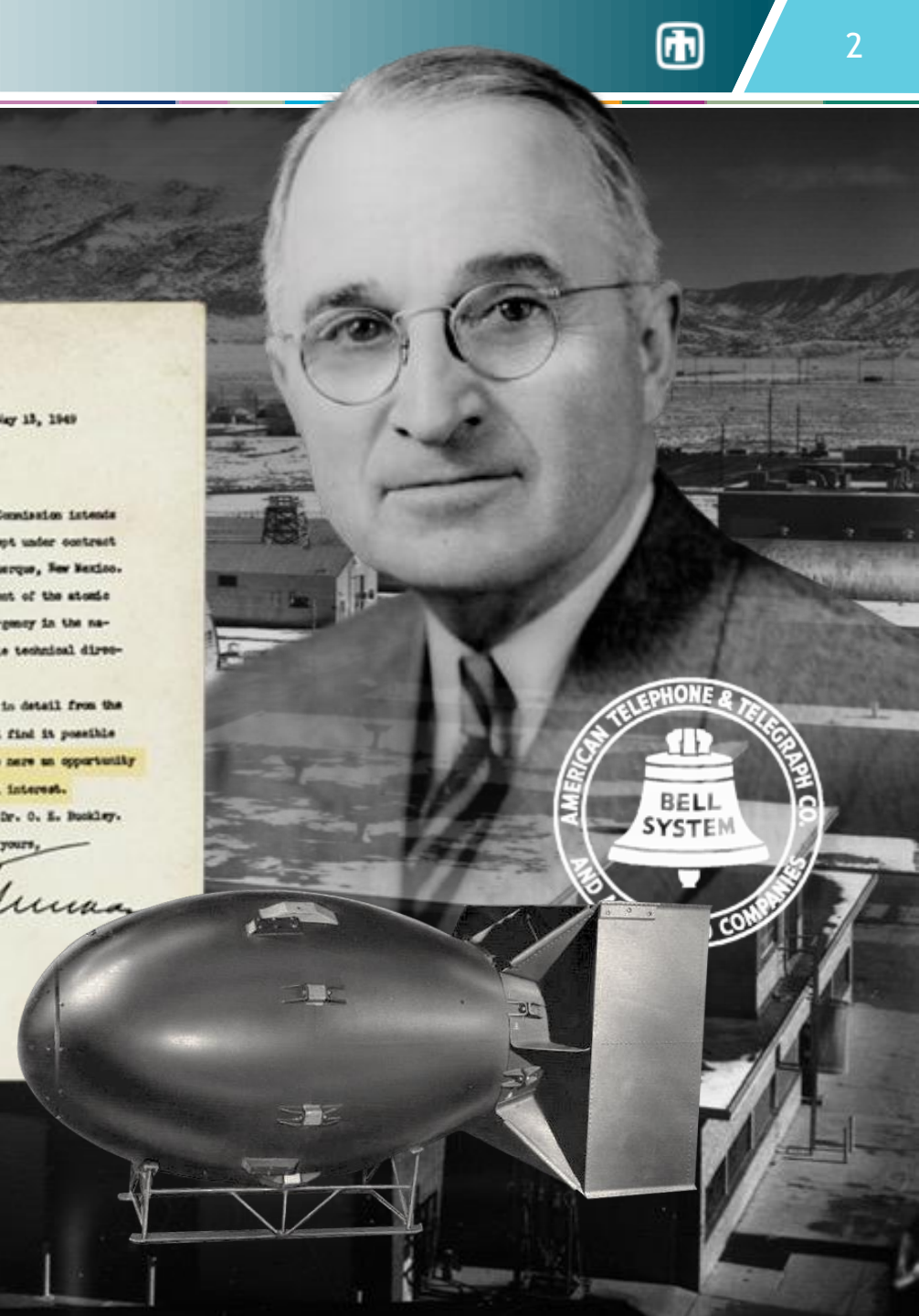
I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

Harry Truman

Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.



SANDIA IS A FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTER MANAGED AND OPERATED BY

National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc.: 2017 – present

Government owned, contractor operated

SANDIA HAS FIVE MAJOR PROGRAM PORTFOLIOS

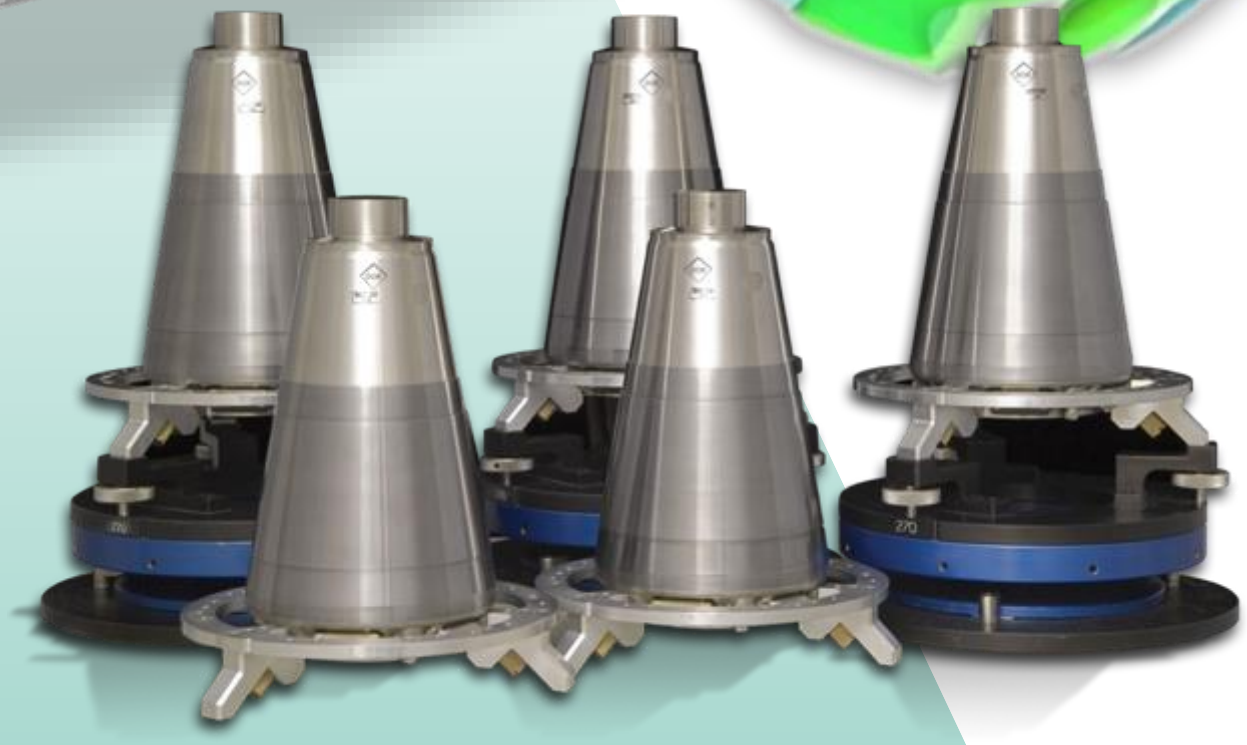
NUCLEAR DETERRENCE

Responsibilities form a critical mandate

Warhead systems engineering & integration

Design agency for nonnuclear components

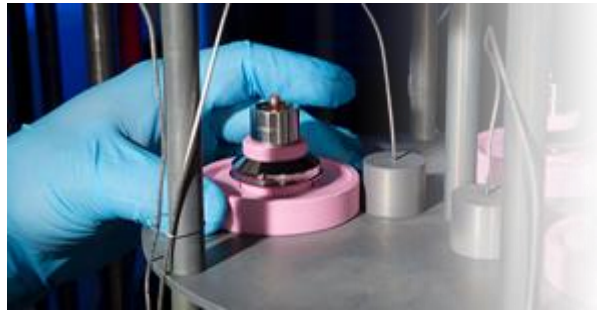
- Gas transfer systems
- Radar
- Safety systems
- Arming, fuzing & firing systems
- Neutron generators



Multidisciplinary capabilities

Required for design, qualification, production, surveillance, computation/ experimentation

- Major environmental test facilities & diagnostics
- Materials sciences
- Light-initiated high explosives
- Computational analytics



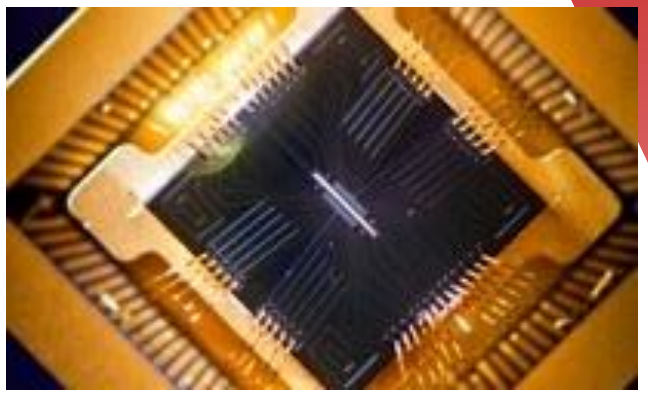
Production agency

- Neutron generators
- Sandia external production
- Microelectronics
- Thermal battery backup

NATIONAL SECURITY PROGRAMS

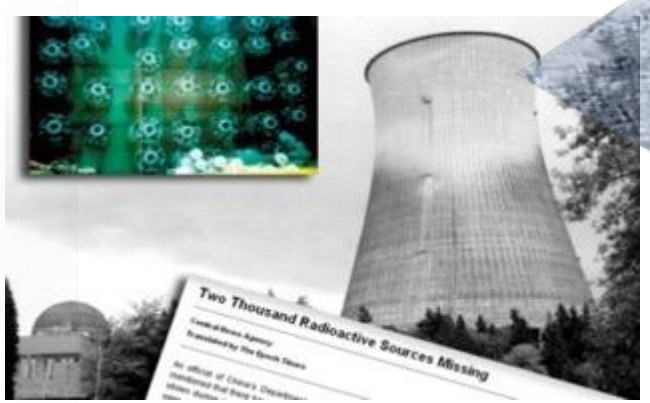
Strengthens our nation's defenders

Information operations



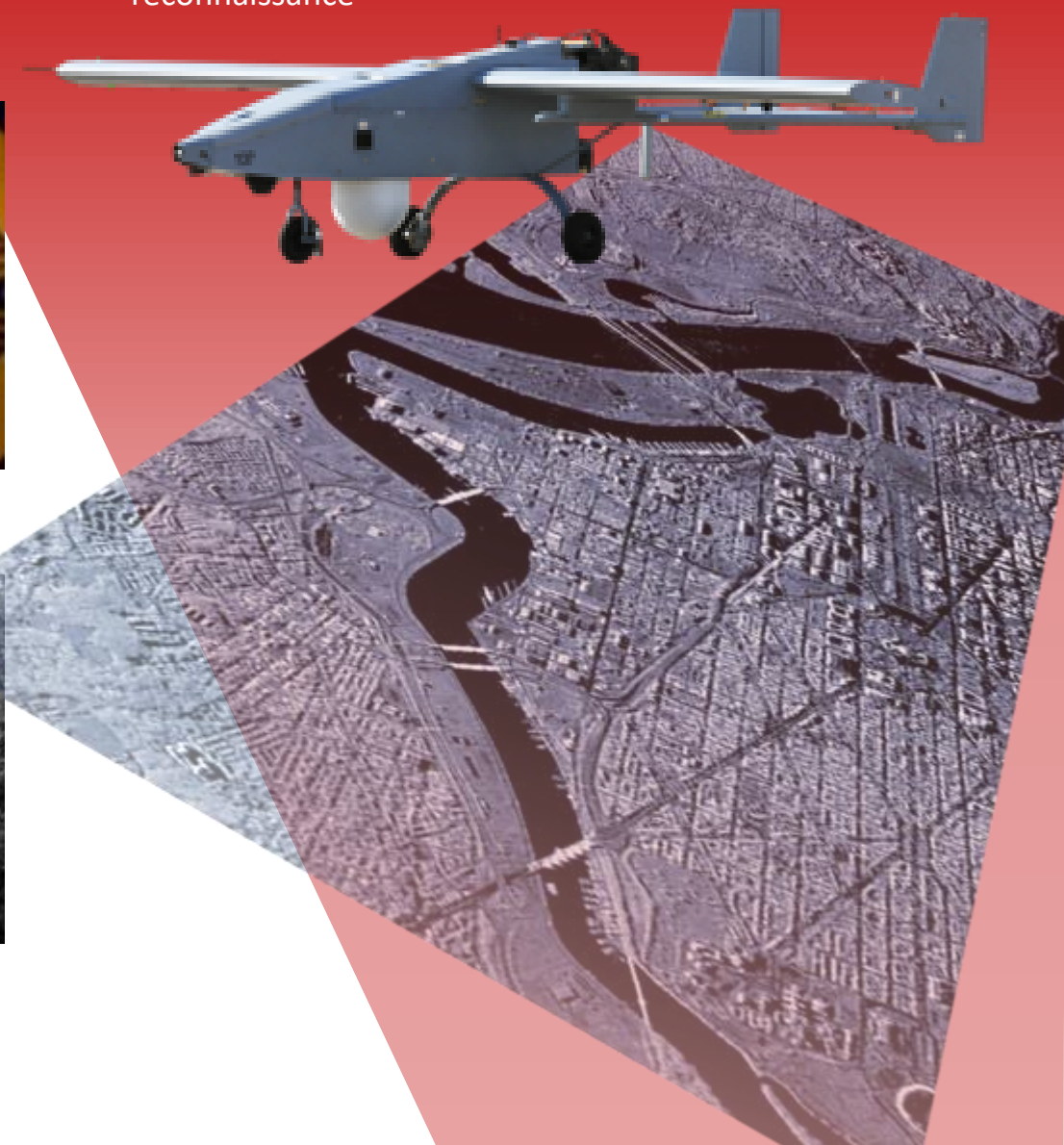
Science & technology products

Integrated military systems



Proliferation assessment

Surveillance & reconnaissance



Advanced Fuzing Technology Dept

Advanced Fuzing Technology seeks to develop fuzing and firing systems that are on the forefront of technology

- **Miniature** --- smallest in the world
- **Multipoint** --- with precise timing
- **Embedded** --- within the explosive system
- **Hardened** --- against mechanical shock
- **Understood** --- by state of the art simulation & experimentation
- **Safe** --- by military standards
- **Reliable** --- by proven demonstration & margin
- **Forward Looking** --- for emerging and future applications

Advanced Fuzing Technology is responsible for the **design of fuzing devices** for both the **Nuclear Deterrence** and **National Security Programs** missions at Sandia

Unique understanding of both mission areas and customer needs

Customers/partnerships

DOE/NNSA

DoD – (AFRL, DTRA, Navy SSP, NSWC IHOEDTD, ARDEC, etc.)

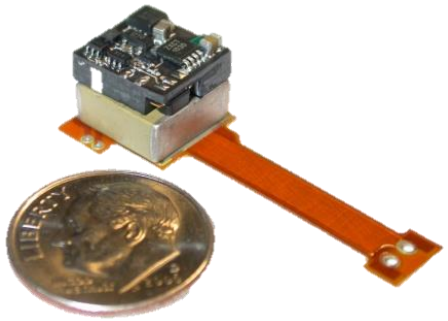
Joint Fuzing Technology Program (JFTP)

Joint Munitions Program (DOE/DoD)

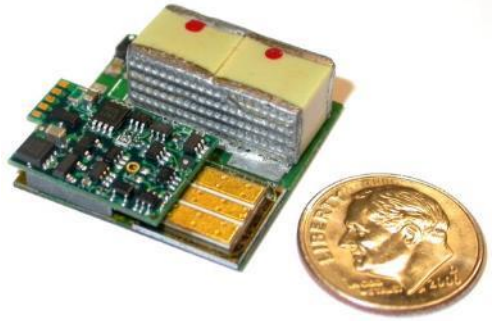
Fuzing industry partners (Raytheon, etc.)

Miniature & Multipoint

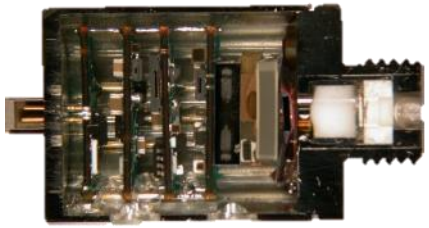
Small Firing Sets w/ Precise Timing



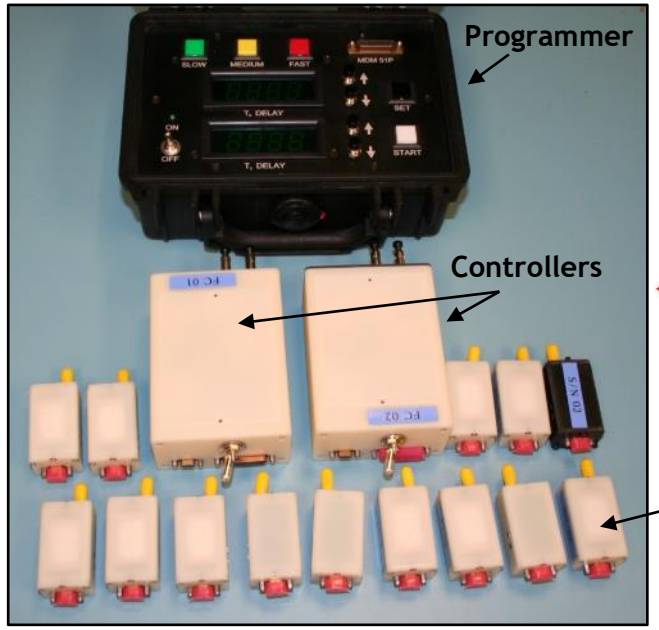
Miniature Electronic Safe-Arm Device



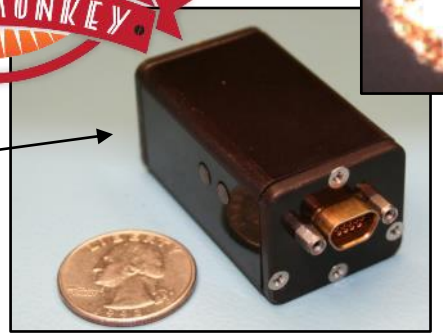
Miniature Electronic Safe-Arm Device



Hermetic, Miniature Firing System with Digital Logic



Firing Node



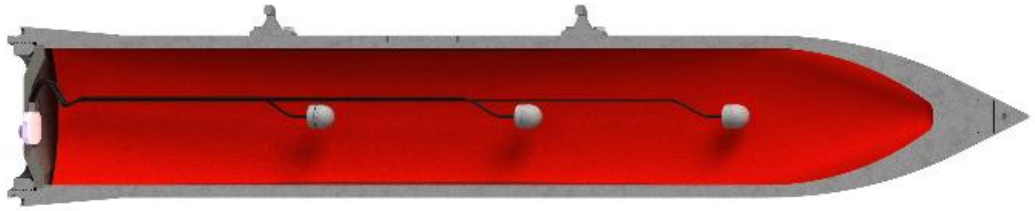
High Speed Video Capture (sub-µs timing)

Embedded

Fuzing systems embedded in fill material for survivability

Traditional Fuzing Design

Distributed Fuzing Design

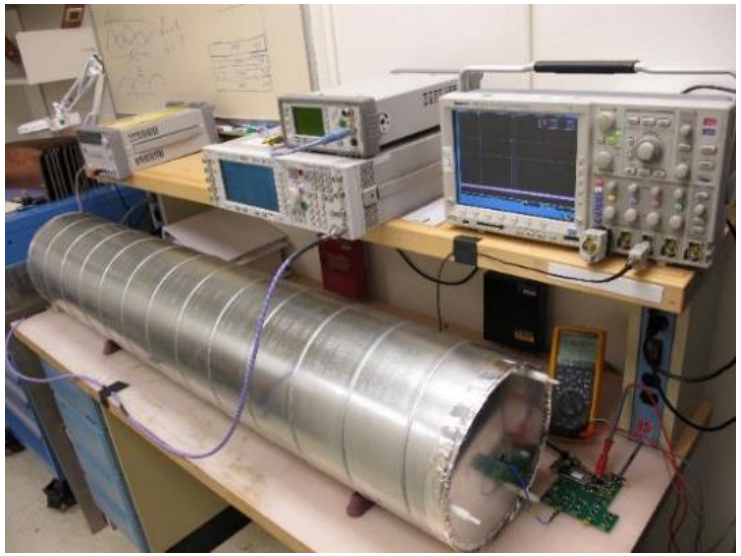


AFRL fuzing architecture design concepts

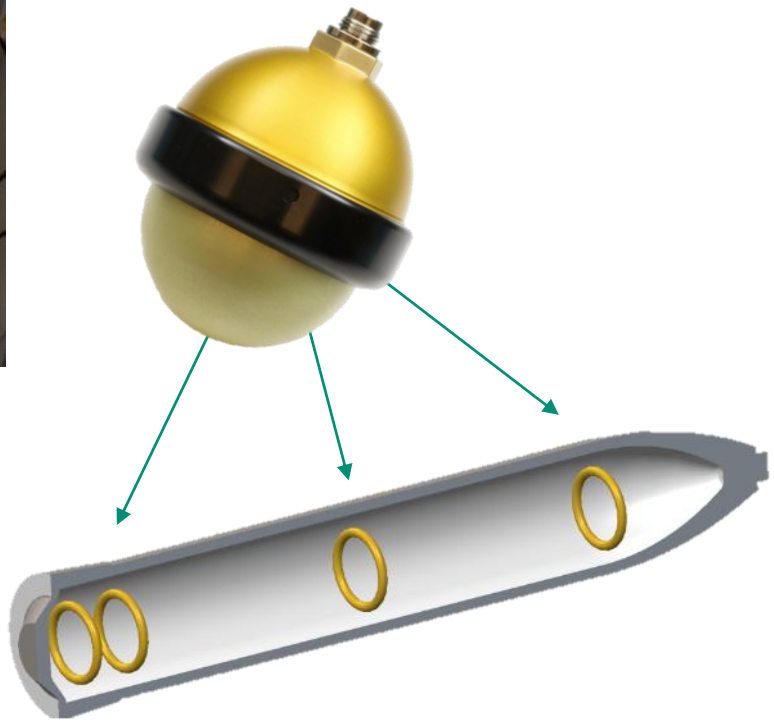
Embedded fuzes can enable survival in harsh system environments

Embedded

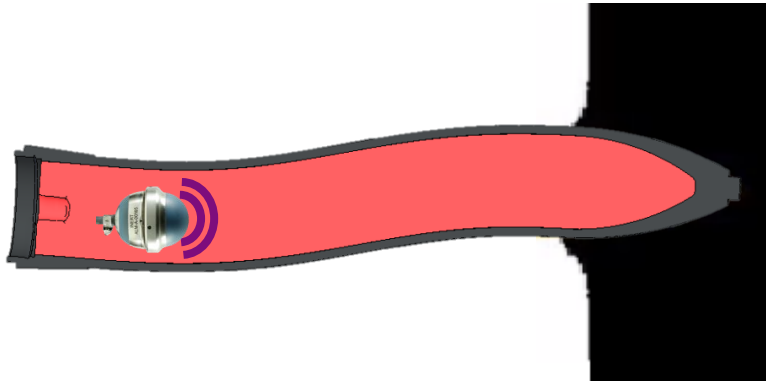
Fuzing systems embedded in fill material for survivability



Benchtop test of power distribution scheme



Notional design for EM power distribution to embedded fuzing nodes



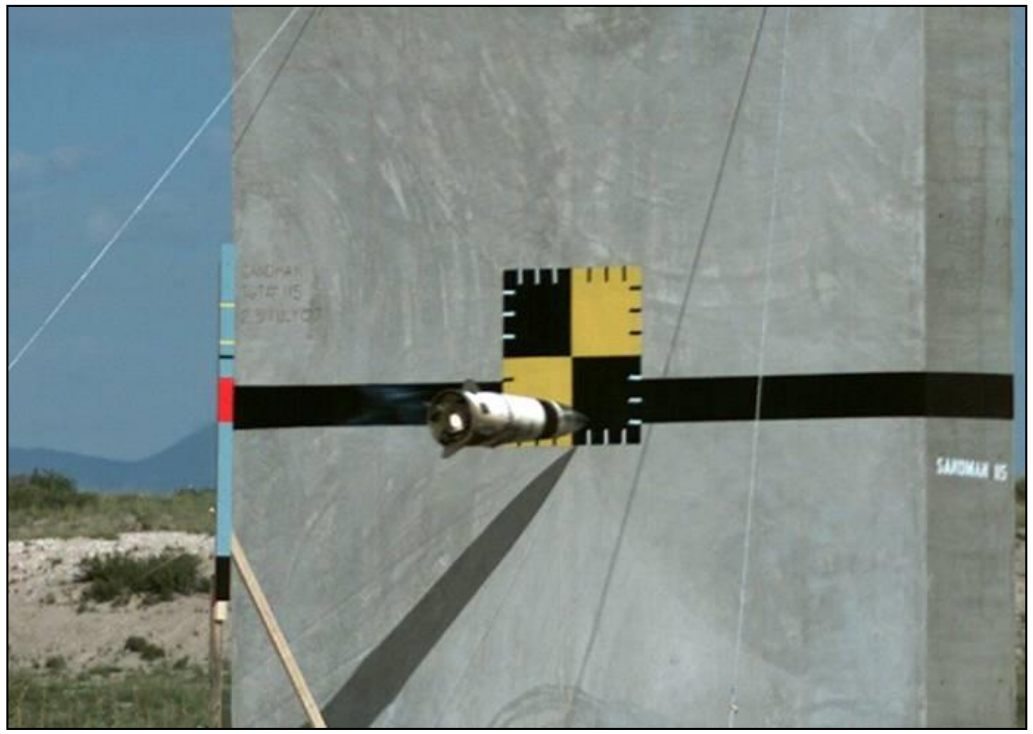
Research into enabling technologies for embedded fuzes in DoD JFTP

Working to provide solutions for embedded fuzes to operate internally without hard-wired connections, including all aspects of operation, such as:

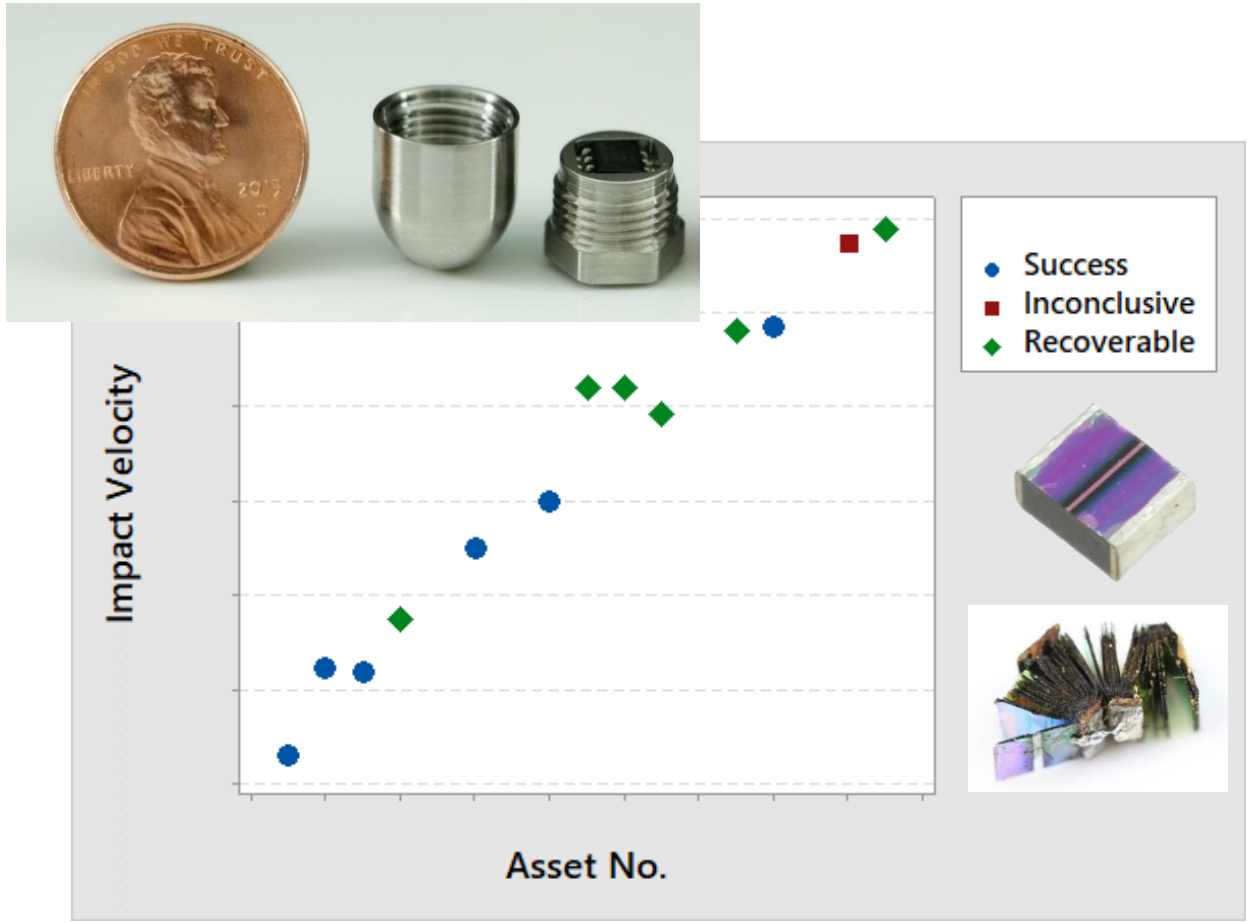
- **Power distribution**
- **Safe/arm communication**
- **External environment detection**

Hardened

Advancing the state of the art to ensure severe environment survivability



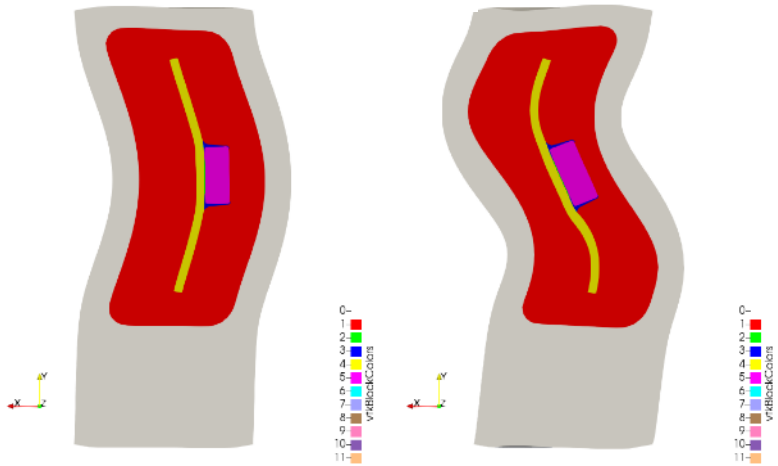
Full scale and sub-scale testing



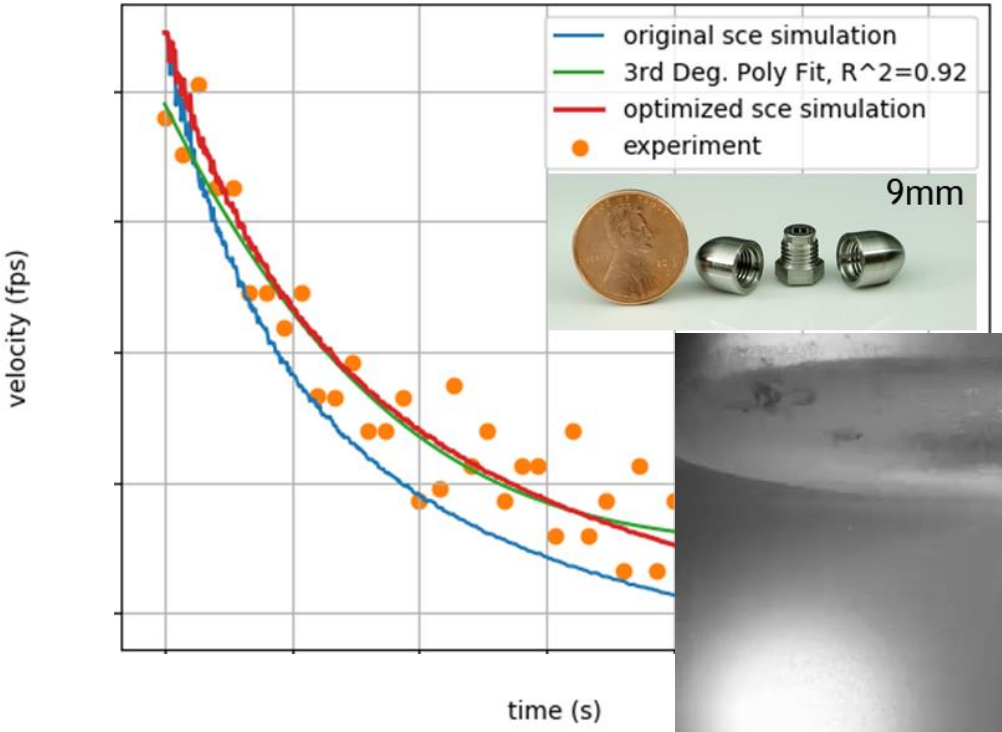
Component/technology evaluation for high velocity impact survivability

Understood

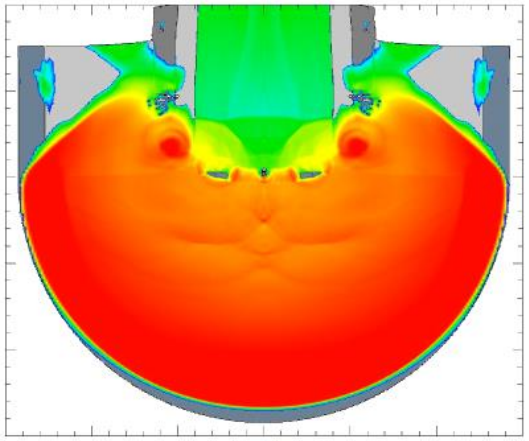
Leveraging capability to fully characterize fuze design space



FEA studies of component designs



Modeling explosives interface for design basis trade studies



Modeling of relevant environments

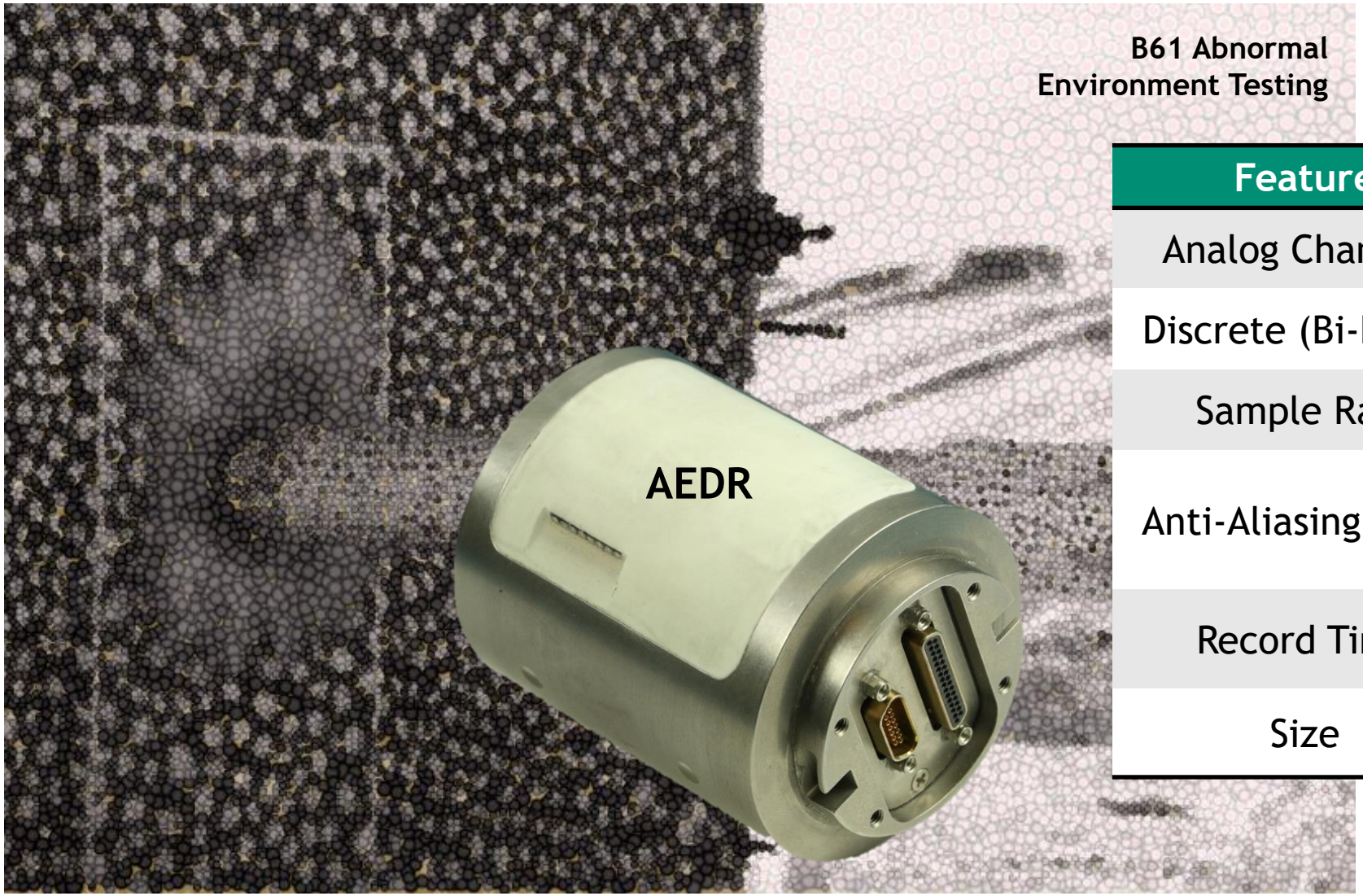
Understood

Conducting novel experimentation to verify designs

EMRTC water impact testing

Understood

Developing state-of-the-art instrumentation to record harsh environments



B61 Abnormal Environment Testing

Feature	Value
Analog Channels	4
Discrete (Bi-Level)	2
Sample Rate	250 ksps
Anti-Aliasing Filter	50 kHz Bandpass, 7-Pole Butterworth
Record Time	213 seconds, with 75 ms pre-trigger
Size	1.4 lbs Ø2.35” x 3.0”

Safe & Reliable

Designs proven through demonstration and designed to safety standards

AFRL Design Verification SPEAR test of SNL embedded fuze.

Leveraged Capabilities

Working across SNL, DoD and DOE

Materials and Component Research

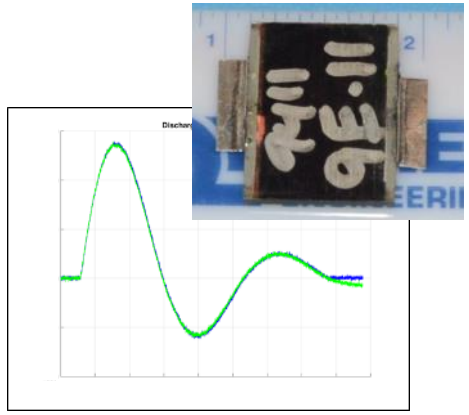
- High Voltage Capacitors
- Additive Manufactured Transformers
- High Voltage Switches

Explosives and Initiation Devices

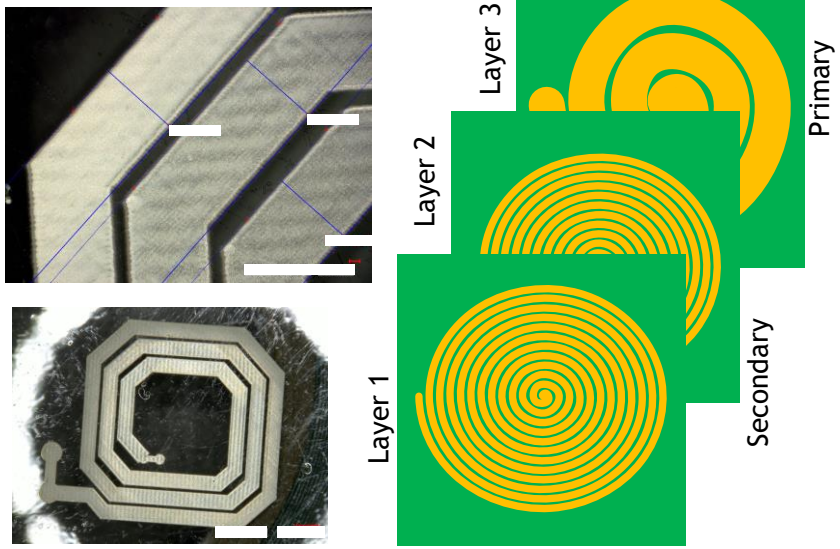
- Direct Header Deposition
- High-g survivable detonators

Survivable Electronics Research

- Shock Isolation Systems
- Encapsulants and Potting Materials development

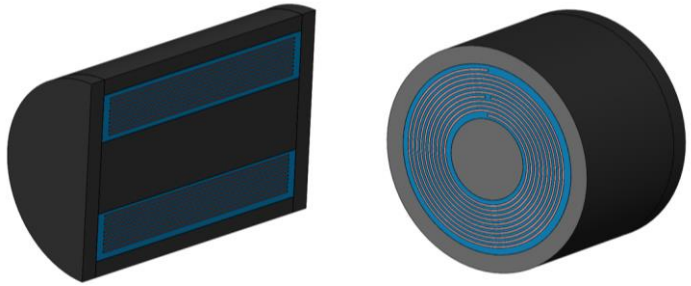


High Voltage Capacitor Development



Coreless Transformer and Direct Write Printing

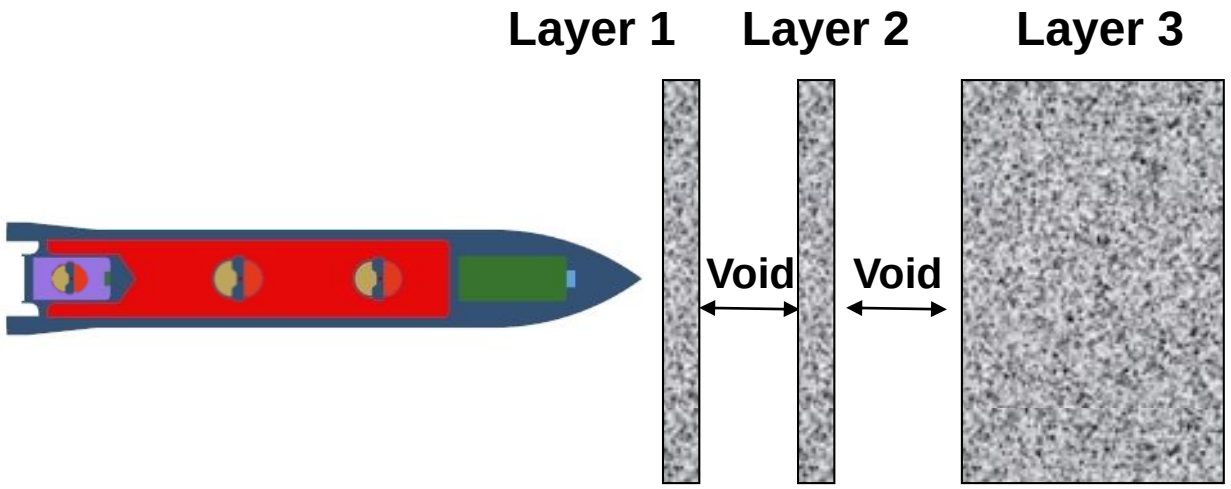
Low Complexity Sprytron



Advanced Manufactured Jellyroll Transformer

Forward Looking

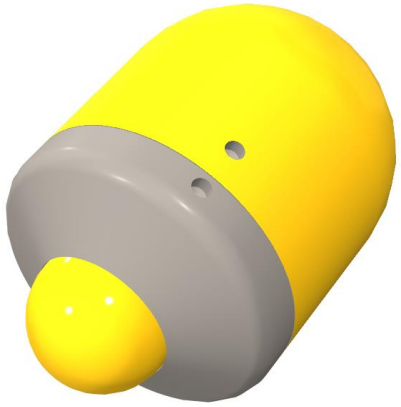
Advancing technologies for future applications through basic research



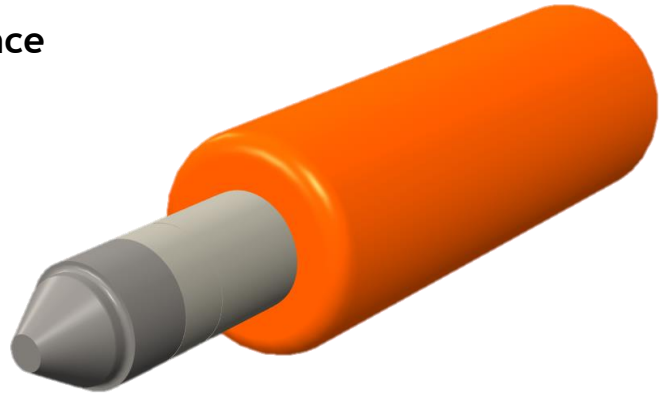
Development of algorithms to enable smart fuze intelligence

Current R&D Efforts

- 3D Printed Fuzing Components
- Wireless Safe, Arm & Fire Communication System
- RF Signature Detection for Smart Fuzing Applications
- Polymer Multi Layer Capattery
- Explosive Model Development



Conceptual designs to survive new environment regimes



Developing recoverable data recorder design concepts

Research into applicability of alternate component technologies for hard target applications

Exceptional Service in the National Interest