

The Advanced Hard Target Warhead Project

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LDRD Day, 9 September 2008

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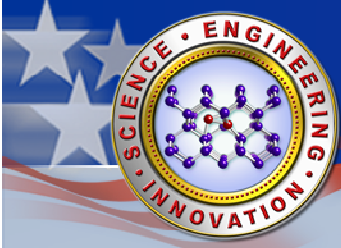
Doug Dederman (5431)

SAND 2008-XXXX



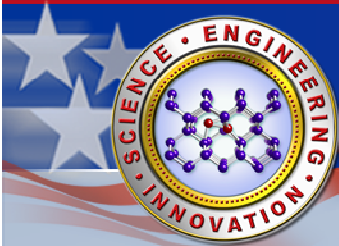
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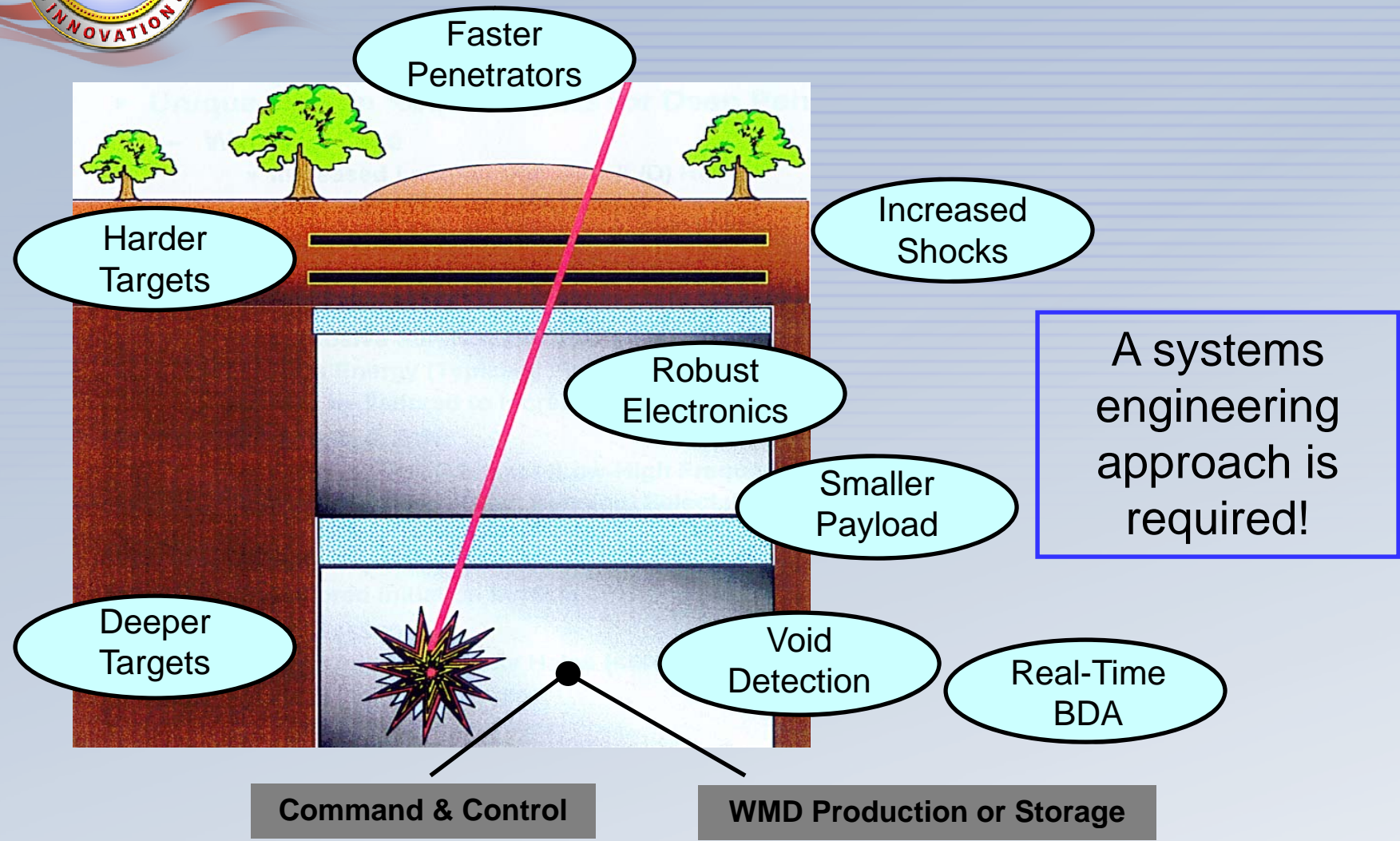


Presentation Outline

- National Security Need
 - Holding HDBTs at risk with conventional EPs requires higher delivery speeds
- Research Problem
 - Characterize the fuze-forward impact environment
- Approach
 - Synergistically use Sandia's broad capabilities to characterize the high-speed impact environment
- Results
 - Measuring accelerations in the high-speed penetration events
- Significance
 - Improved understanding of impact environment
 - Fundamental capability in instrumented, high-speed penetration testing



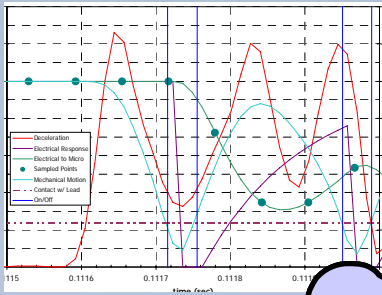
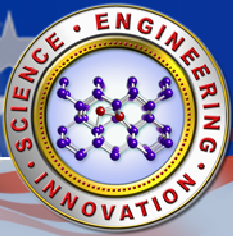
Defeating HDBTs Is a National Security Need



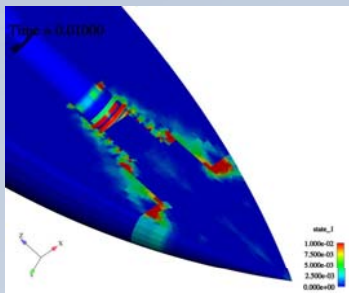
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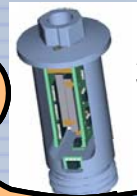
The AHTW Project Used a Synergistic Approach Leveraging Sandia Strengths



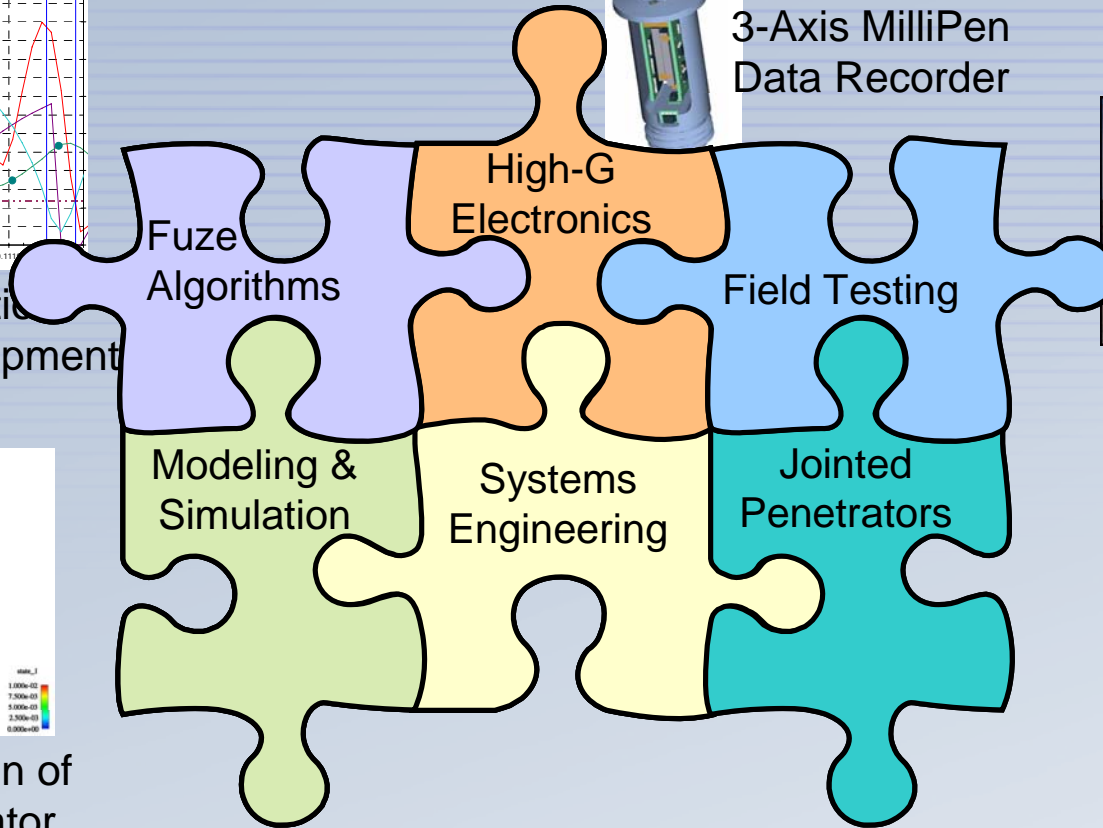
Impact Detection Algorithm Development



Presto Simulation of Jointed Penetrator



3-Axis MilliPen Data Recorder



Field Testing

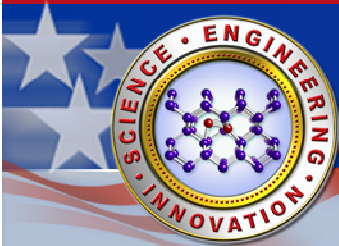


Jointed Penetrators

Sandia has all the pieces of the puzzle for characterizing the high-speed environment

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Project Plan

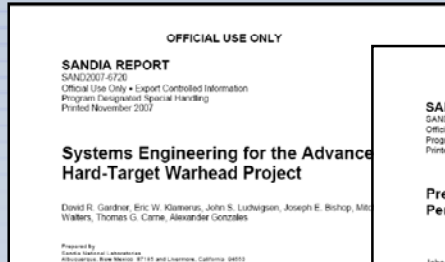
Hypothesis A forward-mounted position will provide a reduced shock environment for the fuze

Goal Characterize the high-speed penetration environment to advance the technology base for HDBT defeat

FY 2006: Assess system issues for fuze-forward, high-speed penetrators using modeling & simulation

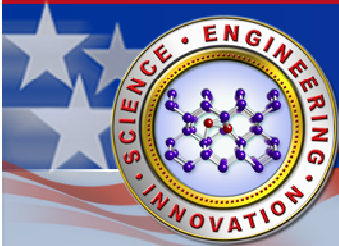
FY 2007: Characterize the high-speed, penetration environment and assess ModSim capabilities

FY 2008: Further characterize the high-speed penetration environment and demonstrate a void-counting fuze algorithm



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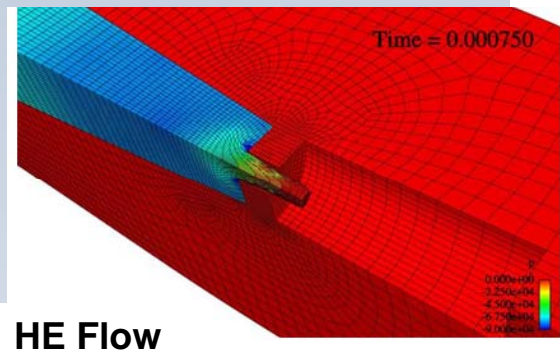
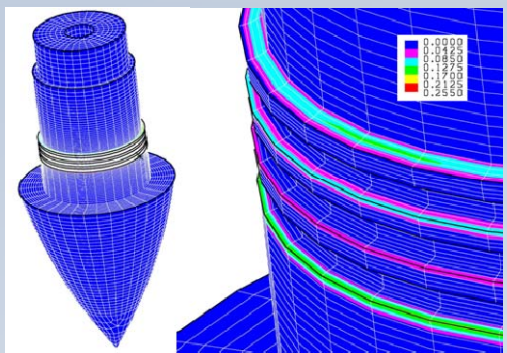
ModSim Tool Selection

PENCURV+

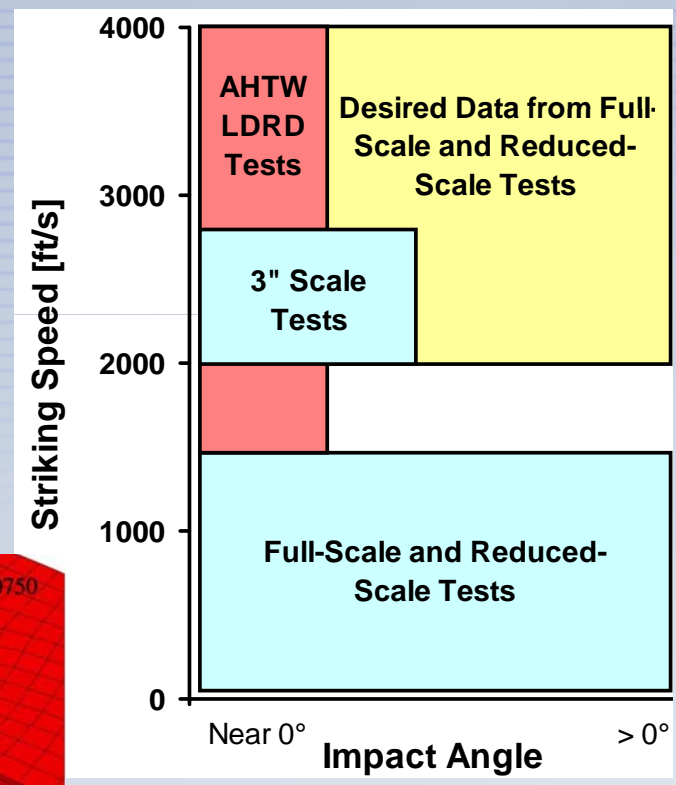
- Scoping studies

Presto/SCE

- Mechanical analyses
- Penetrator trajectory stability
- HE flow



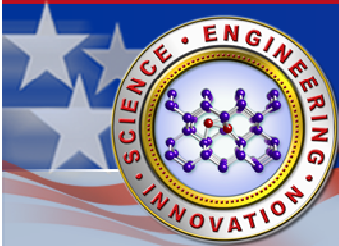
HE Flow



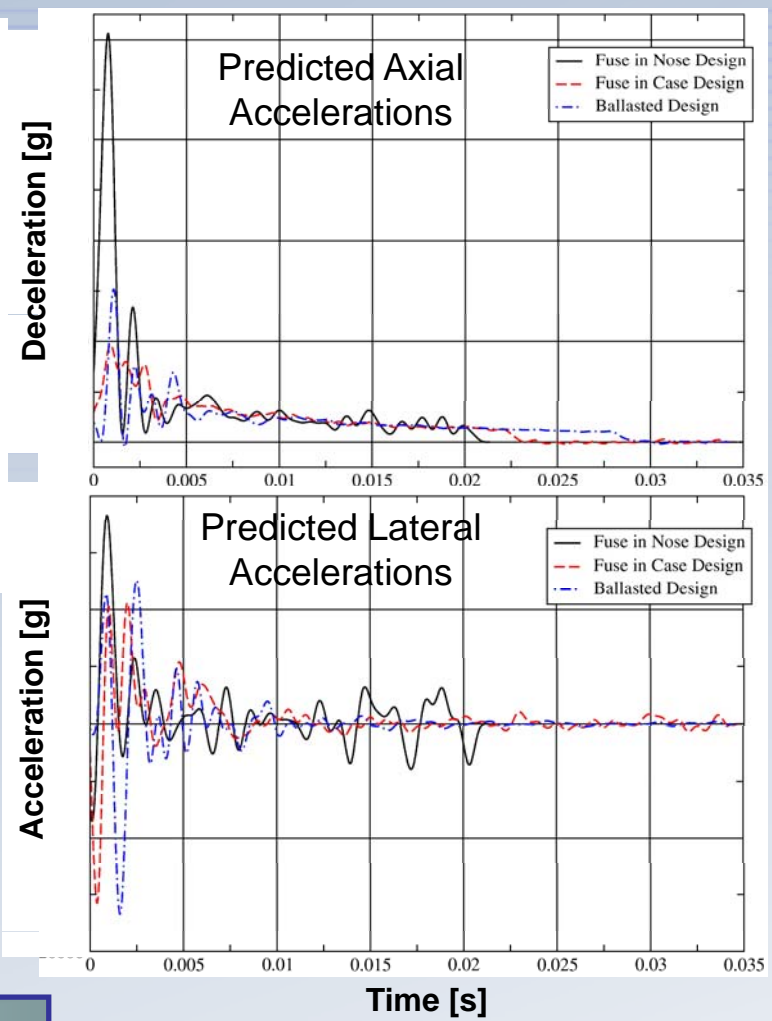
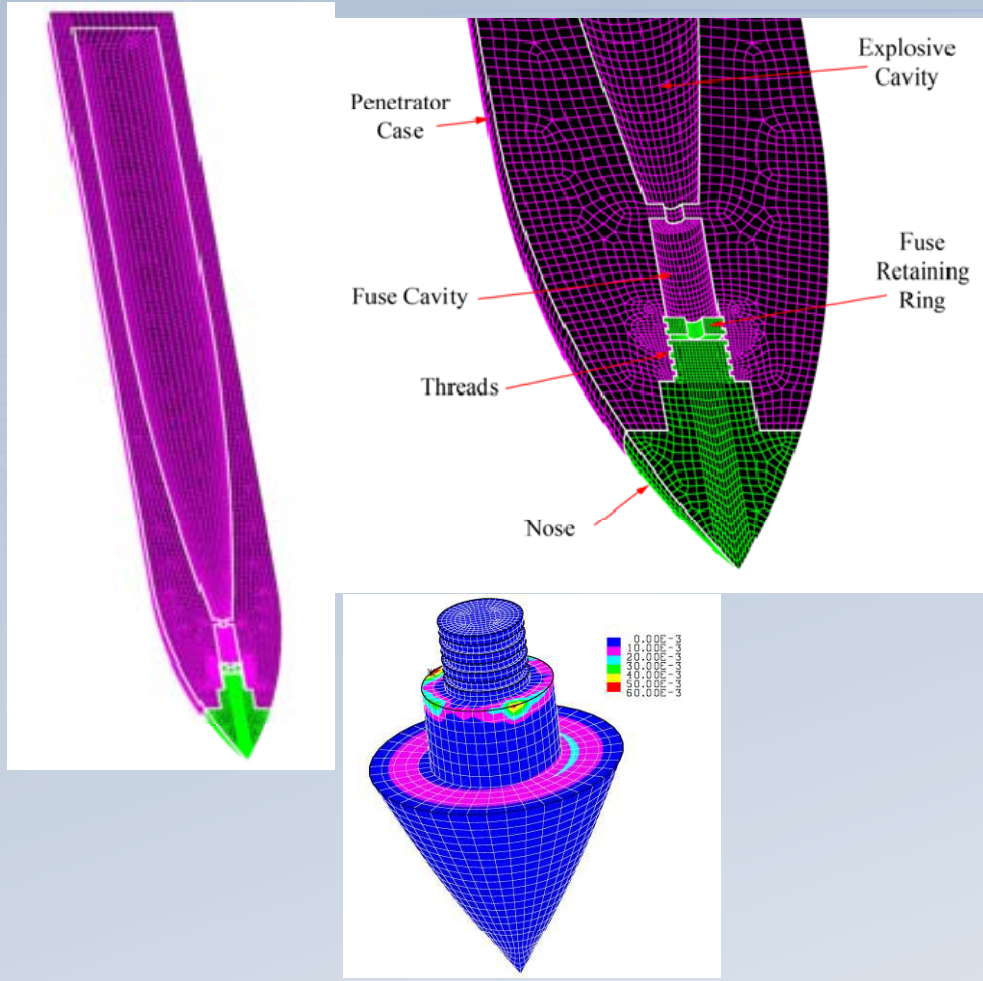
Alegra/SHISM: Penetrator trajectory stability

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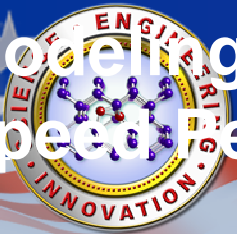
Fuze-in-the-Case Design



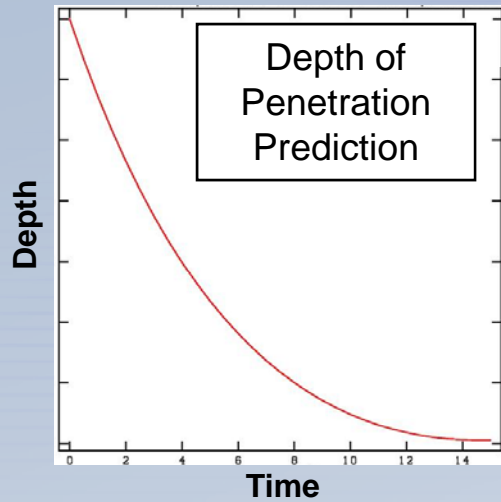
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Time [s]



Modeling and Simulation Is Crucial to High-Speed Penetrator Test Design

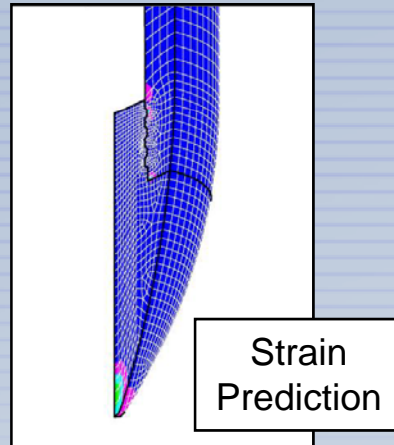


Target Design



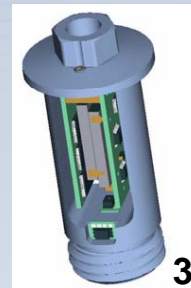
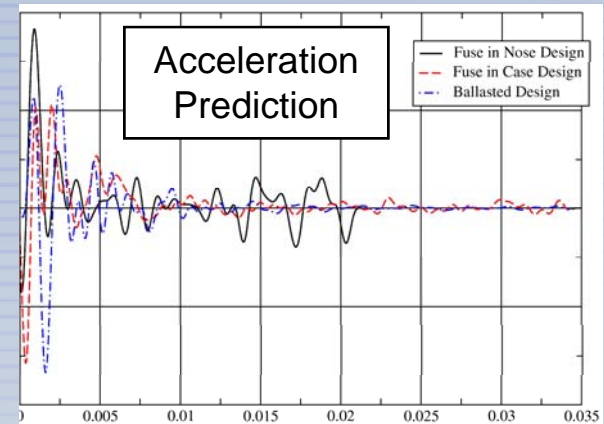
Concrete Target

Penetrator Design

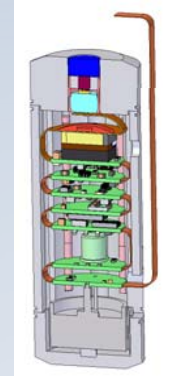


Penetrator Joint

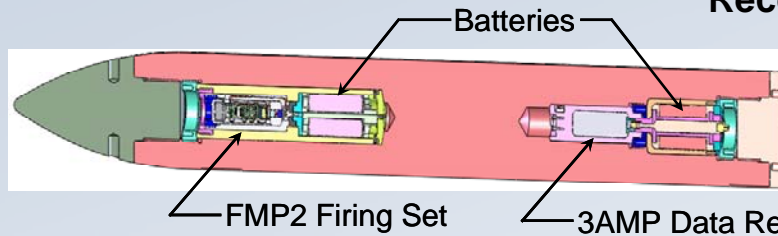
Instrumentation Design

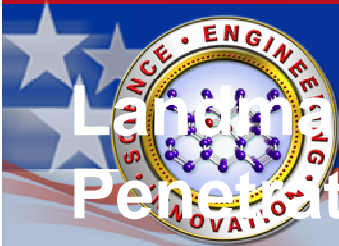


3AMP Data Recorder



FMP2 Firing Set





Landmark High-Speed, Instrumented, Jointed-Penetrator Test



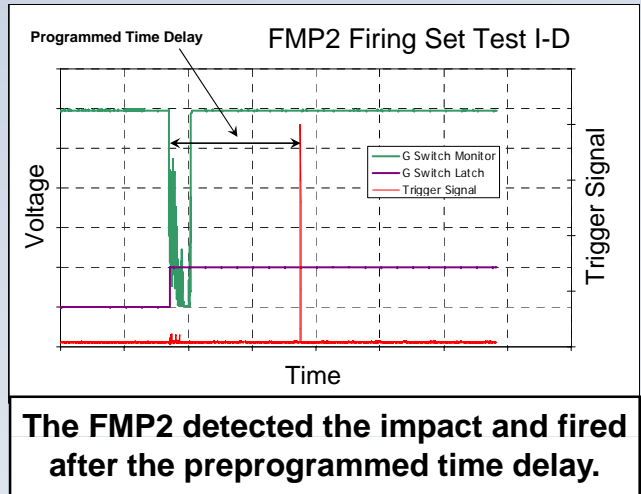
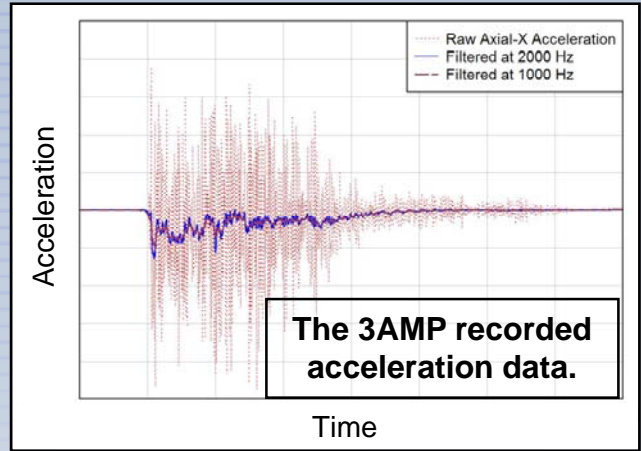
Achieved a record high striking speed: 3900 ft/s.

26 July 2007



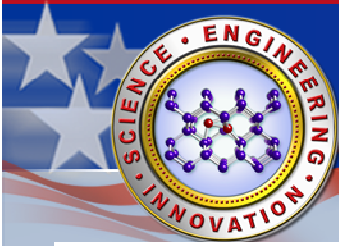
The jointed penetrator survived the impact.

Established a fundamental capability for Sandia in instrumented, high-speed penetration testing.

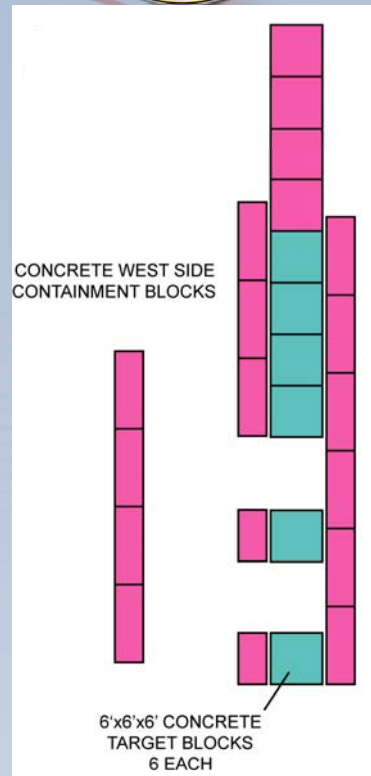


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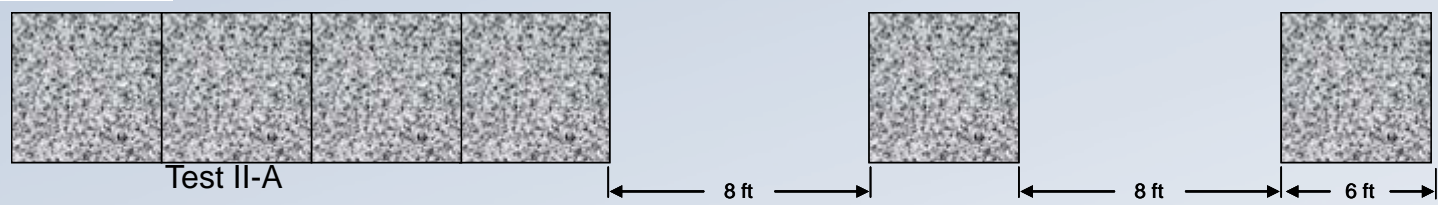
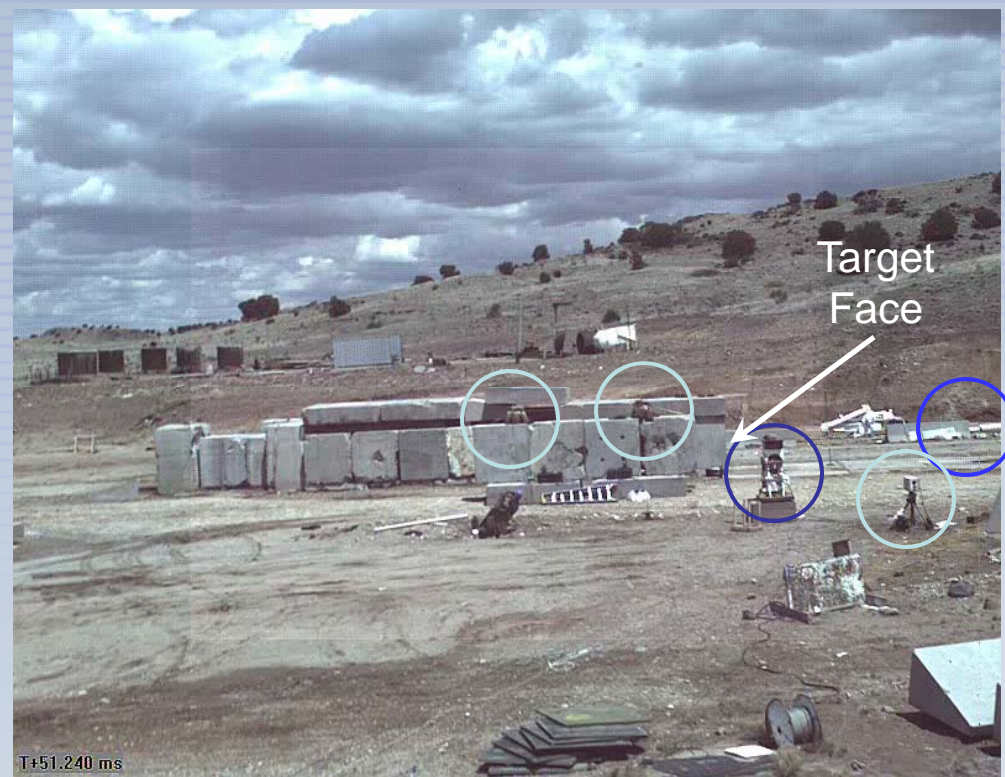
Test II-B Overview



Video Camera

IM Camera

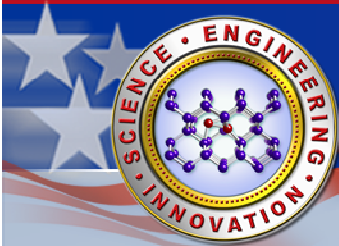
Gun Barrel



Double-Gap Target Configuration

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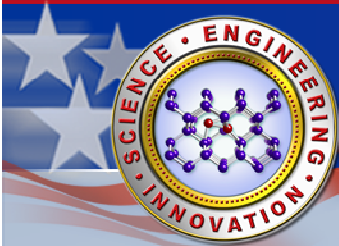




Test II-B Impact

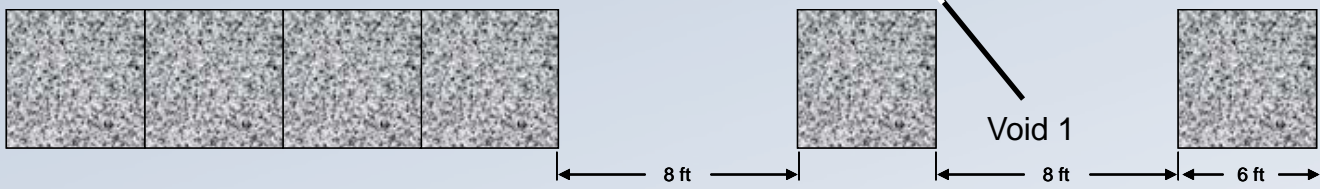
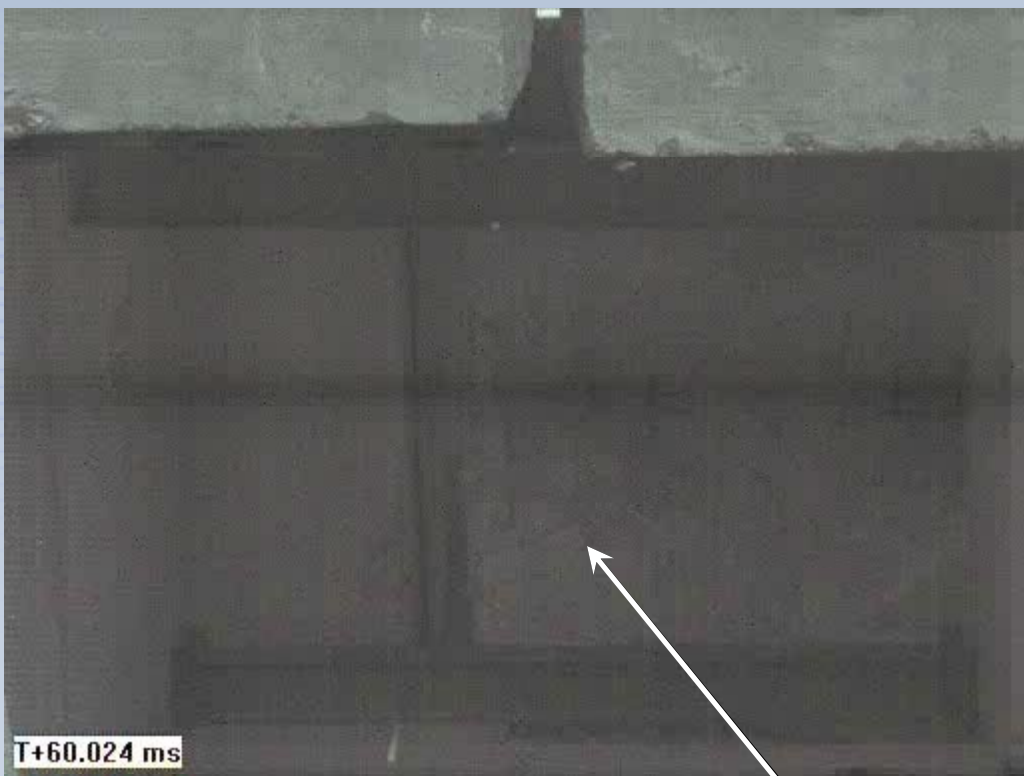


T+50.027 ms



Test II-B Void 1

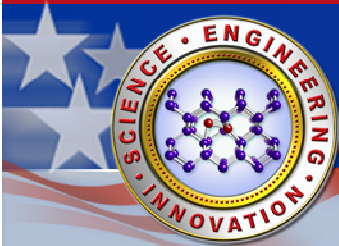
*Note that the penetrator has retained most of its paint.



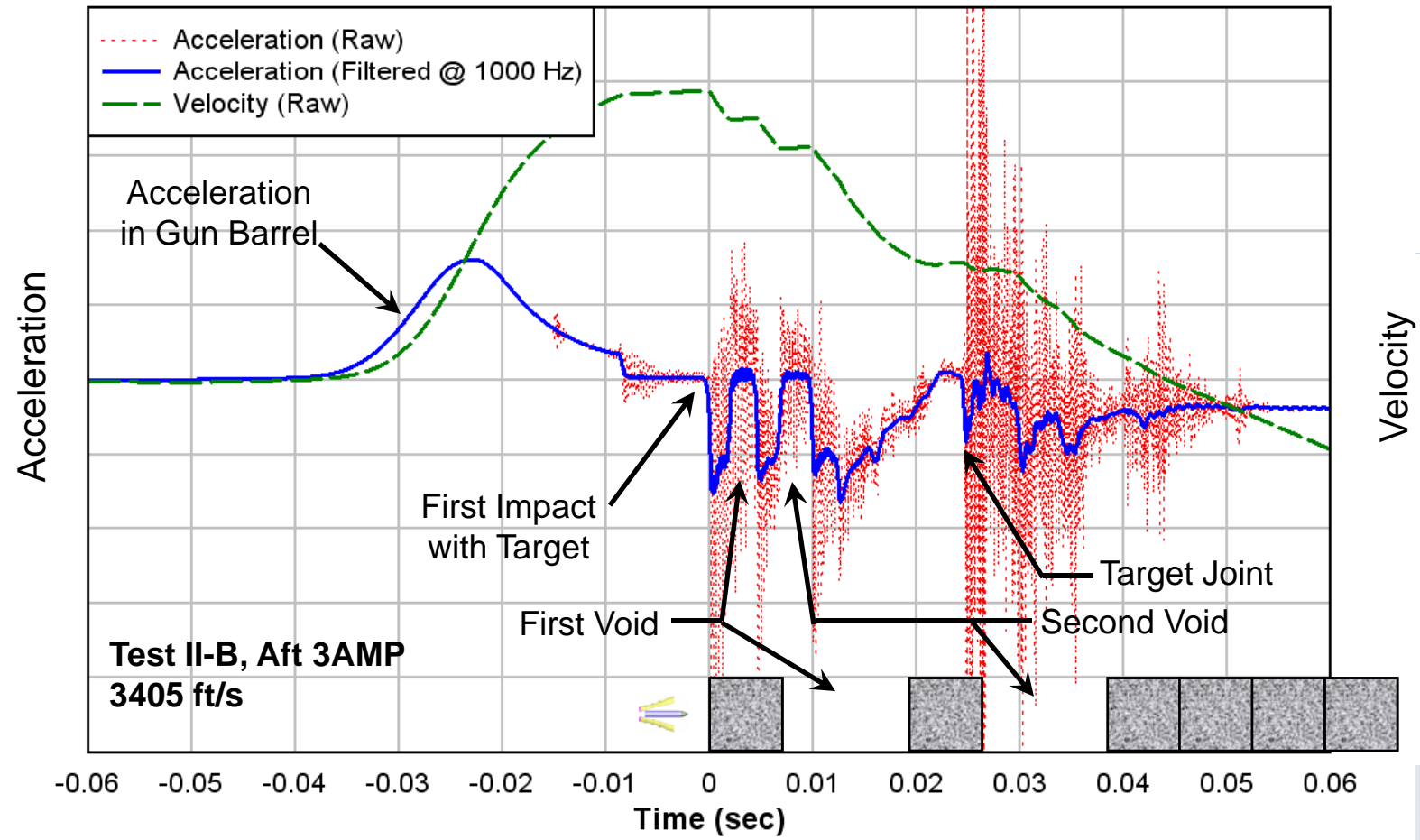
Double-Gap Target Configuration

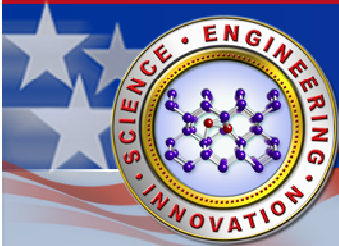
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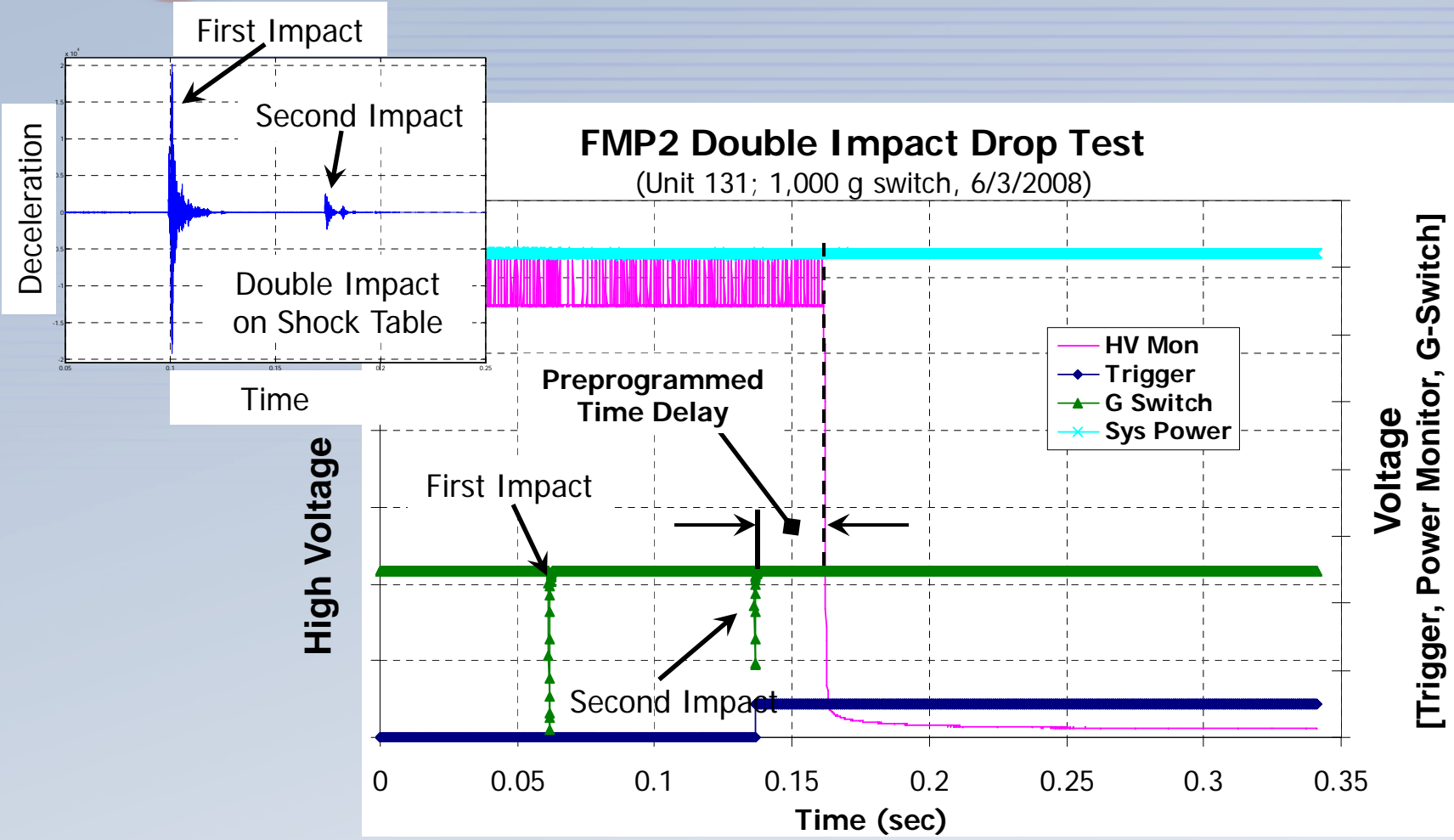


Annotated Impact Plot





Successful Drop Table Algorithm Tests



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The Advanced Hard Target Warhead Roadmap

S&T Support

- Materials
- Computational Tools
- Microelectronics

Get smarter, NOT perpetuate what is not working

LDRD provides foundation to generate new capability and integrate knowledge from other activities

✓ Provide fundamental understanding of environment

Past Knowledge

- DoD Programs
- DOE A&E Activity

Case – Jointed, High Velocity, Robust

Fuze – Smarter, More Reliable

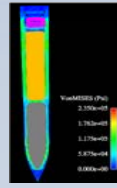
Fill – Advanced materials and Det Design

Improved Tools, Instrumentation and Test

New Programs

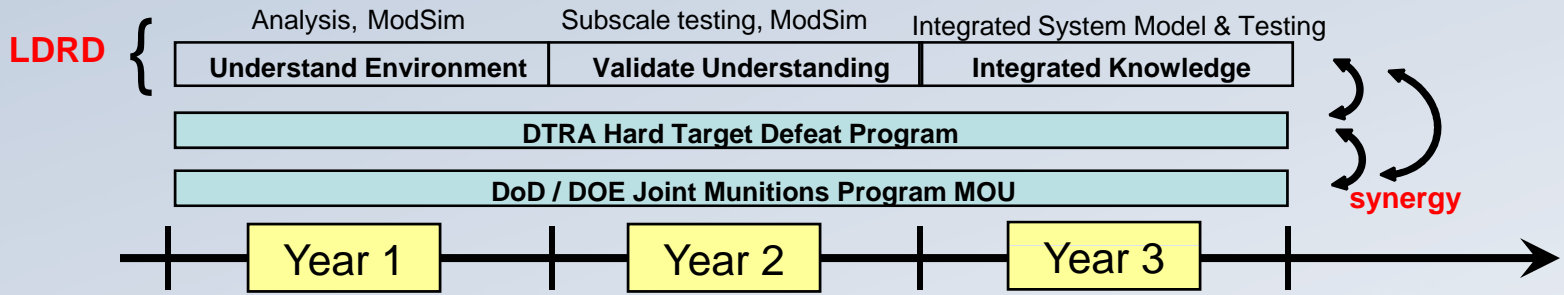
- Systems
- Instrumentation
- Test

Improved Analysis, M&S Capability



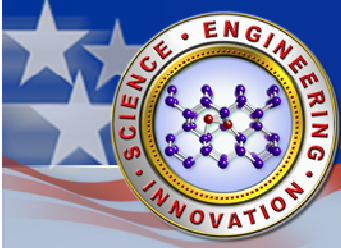
Advanced Warhead

- Enhanced Lethality
- Smart, Reliable Fuze
- Advanced Case Design
- Real-Time BDA



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Summary & Conclusions

- **Explored system issues for high-speed penetrators**
 - Considered new jointed fuze-forward penetrator designs
- **Characterized the high-speed penetration environment**
 - Attained striking speeds of 2500-4000 ft/s
 - Measured acceleration data at some of highest speeds ever
 - Demonstrated FMP2 firing set function at the highest speeds ever
- **Provided improved technology for our Nation's defense**
 - Developed a fundamental capability in instrumented, high-speed penetration testing
 - Developed a G-switch void-counting algorithm