



A UNITARY DEMOLITION WARHEAD

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Unitary Demolition Warhead

Introduction



- **TACOM-ARDEC Warheads**
 - Long history of warheads design
 - Technology development
 - Application
- **Demolition**
 - Damage or demolish concrete, masonry, earth etc.
 - Lightweight and simple
 - Unitary warhead concepts



Unitary Demolition Warhead

Background



- **Penetration Warheads**
 - Shaped charges and EFPs
 - Deep penetration, but limited damage
- **Blast Warheads**
 - High impulse on outside surfaces
 - Increased damage if energy released inside target
- **Multi-Stage Warhead**
 - Effective but size and weight limitations
- **Terminal Chemical Energy Warhead**
 - Unitary Warhead Concept
 - Reactive liner materials
 - Penetrate target then release chemical energy
 - Easy to adapt to multiple delivery systems



Unitary Demolition Warhead

Modeling



- **Reactive Liner Materials**
 - JAGUAR/CHEETAH thermochemical EOS calculations
 - Downselected family of solid reactive liner material
- **Warhead Mechanics**
 - CALE Arbitrary Lagrange-Eulerian (LLNL)
 - Reactive liner material: EOS from simple mixing rules, low value of perfect plasticity



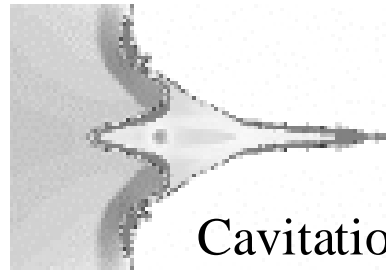
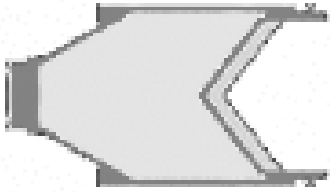
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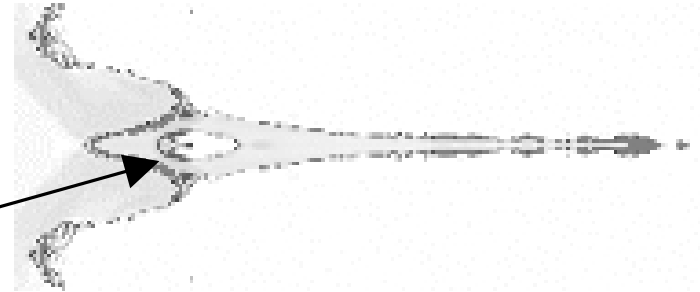
Modeling: Design Issues



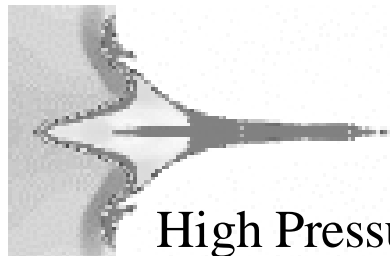
Cavitation



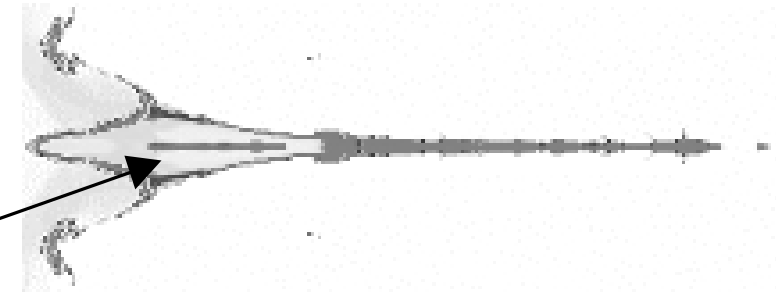
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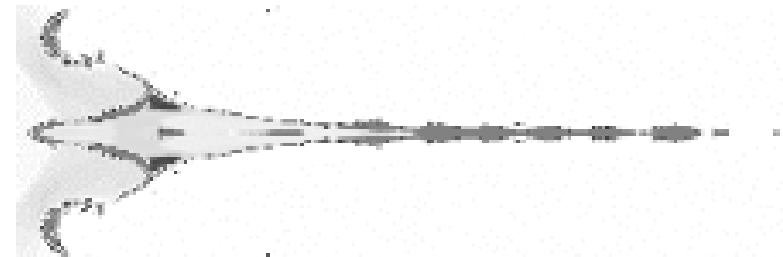
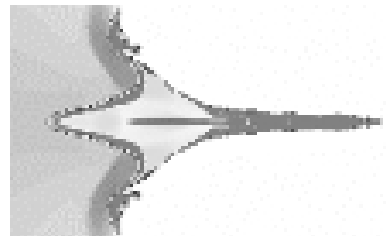
High Pressure



High Pressure



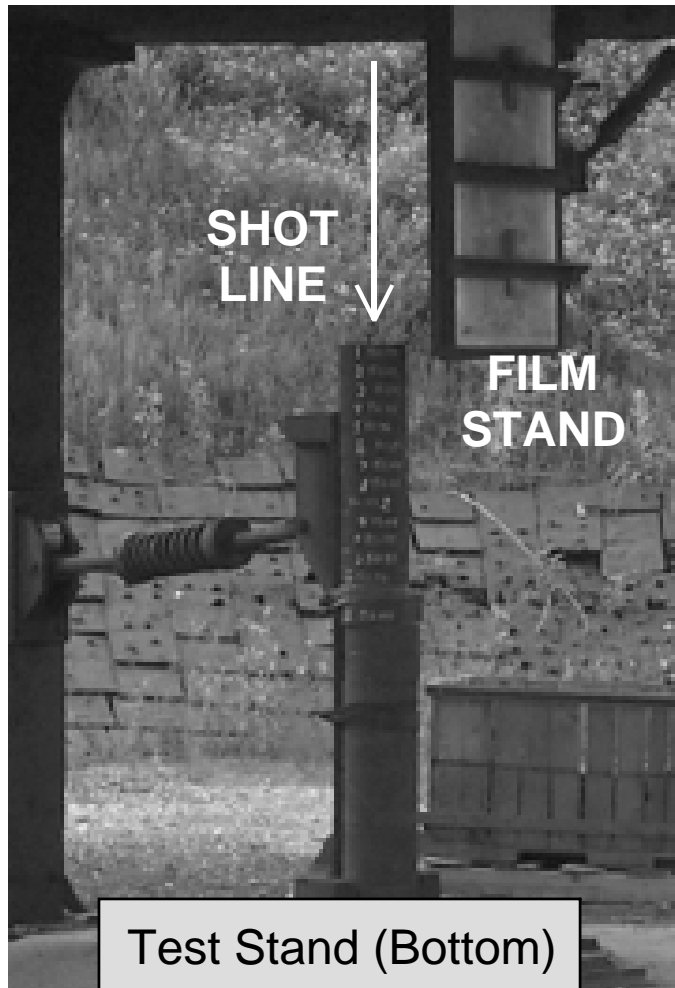
Final Design



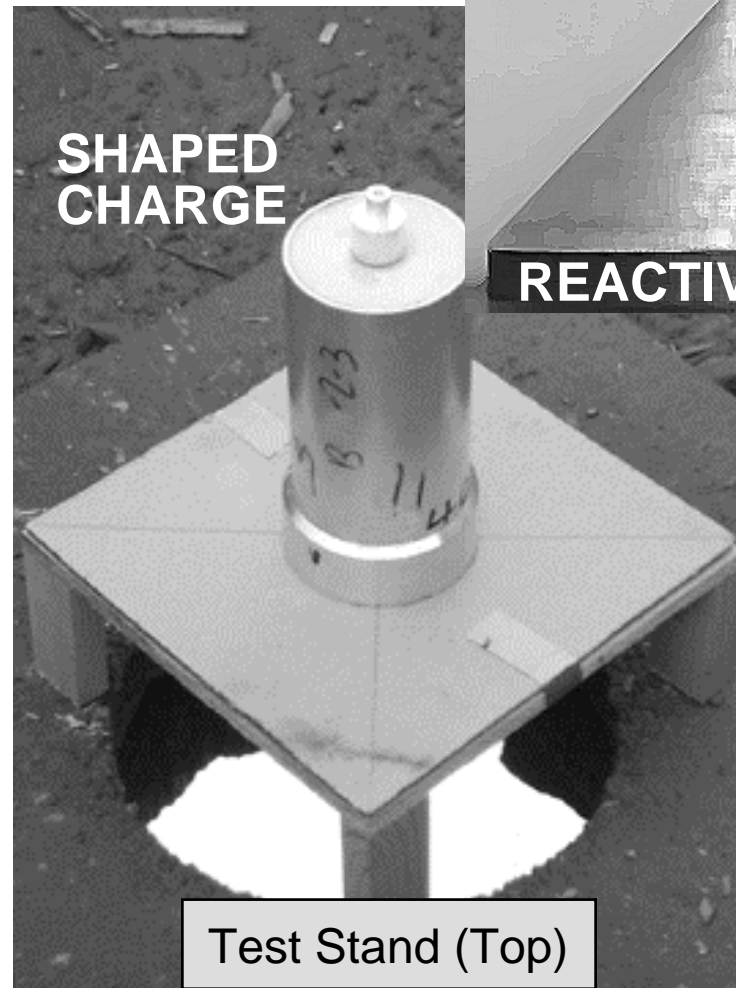


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Jet Characterization



Test Stand (Bottom)



Test Stand (Top)

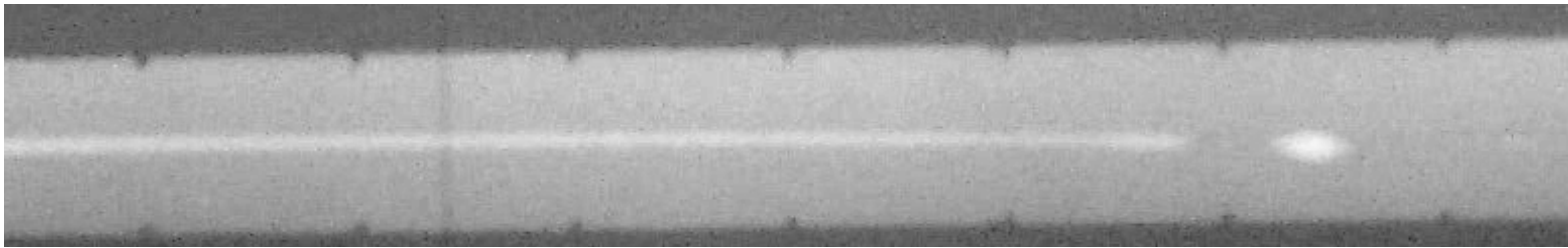


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Jet Characterization



AL 1100-0 Jet (Mass Matched)



Reactive Liner Jet



Very similar!



Unitary Demolition Warhead

Concrete Target Attack



- Reactive Liner Material
 - AL1100-0 Baseline
 - Reactant deficient
 - Reactant balanced
 - Reactant rich
- Stand-off comparison
 - One CD baseline
 - $\frac{1}{2}$ and 2 CD
 - Reactant deficient only

Warhead: 81mm diameter

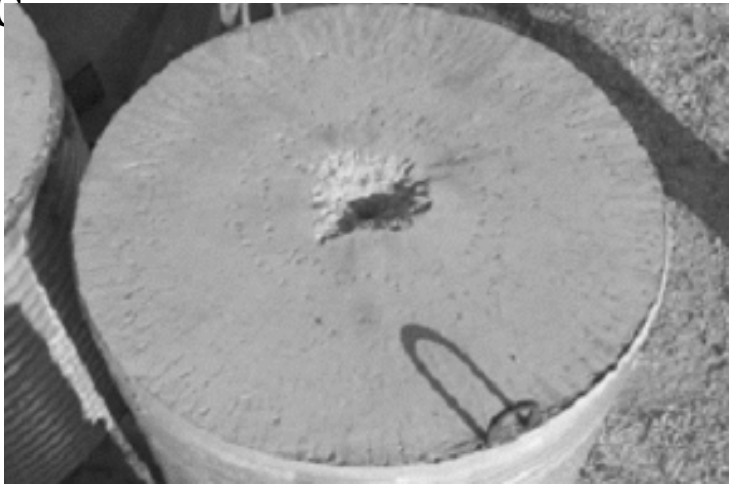
Target: 152cm diameter X 152cm height concrete



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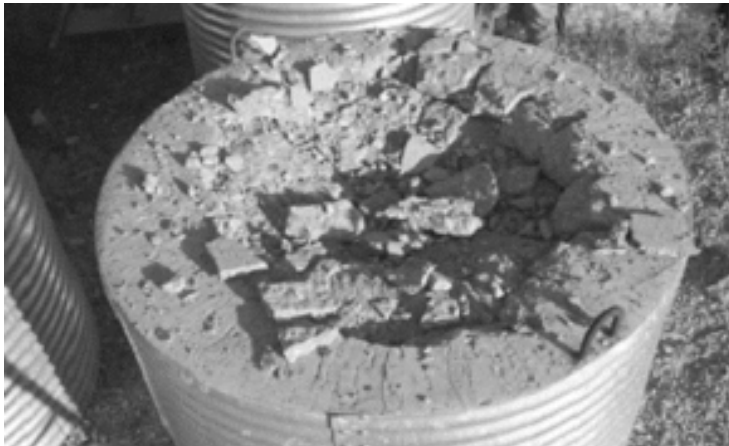
Target Results: Reactive Material



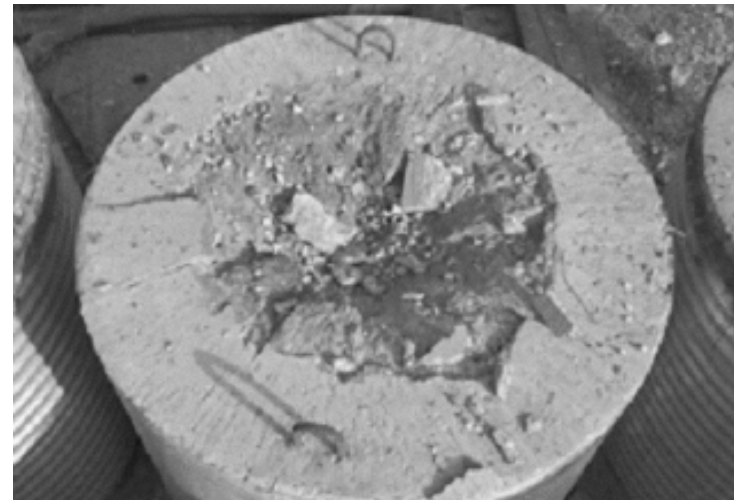
AL1100-0



Reactant Deficient



Reactant Balanced



Reactant Rich

Balanced did most damage!

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Radial Cracking





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Target Results: Standoff



1/2 Charge Diameter



1 Charge Diameter



2 Charge Diameters



Large performance drop-off at 2 CDs!

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Summary



- Unitary Demolition Warhead works!
 - Target penetration
 - Reactive liner material energy release inside the target
- Reactant balanced demonstrated highest performance (most concrete damage)
- Performance drop-off at 2 CD standoff
- Ongoing work
 - Pressed explosives (rather than Octol)
 - Scaling effects (larger warhead)



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