



# 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



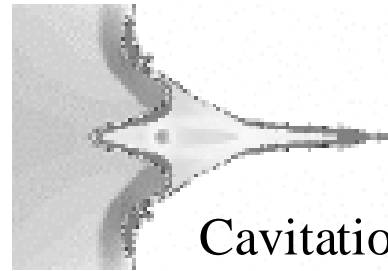
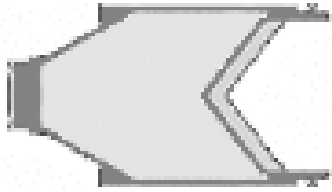
AMC

# Unitary Demolition Warhead

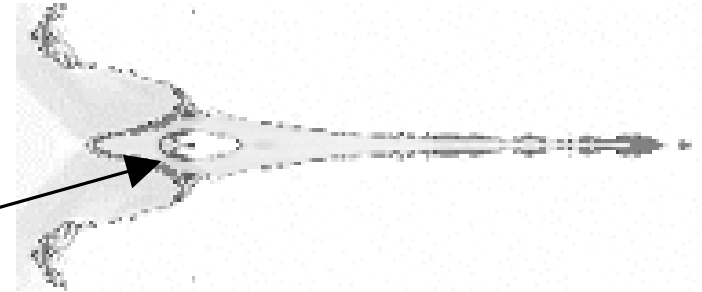
## *Modeling: Design Issues*



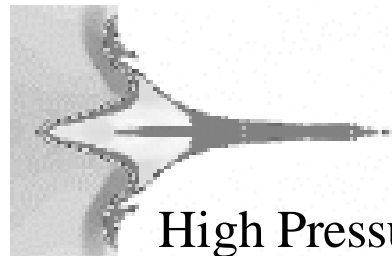
### Cavitation



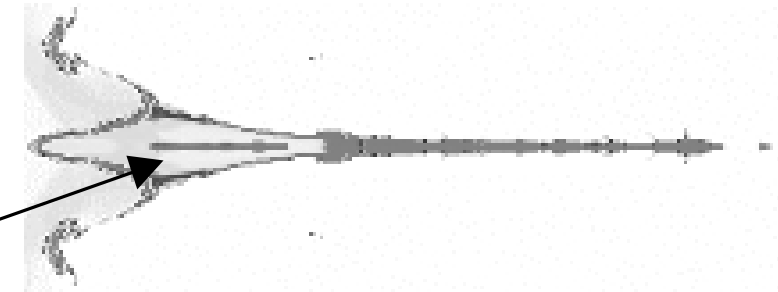
Cavitation



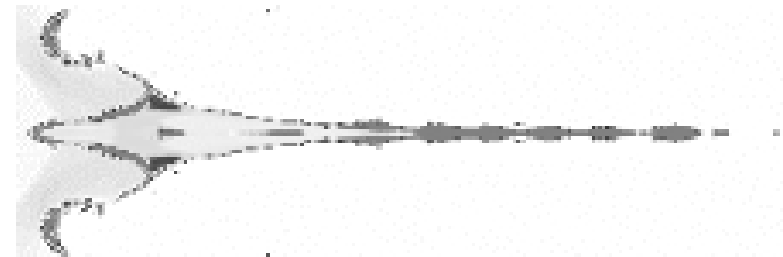
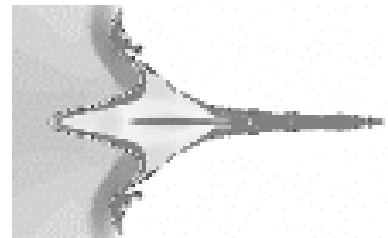
### High Pressure



High Pressure



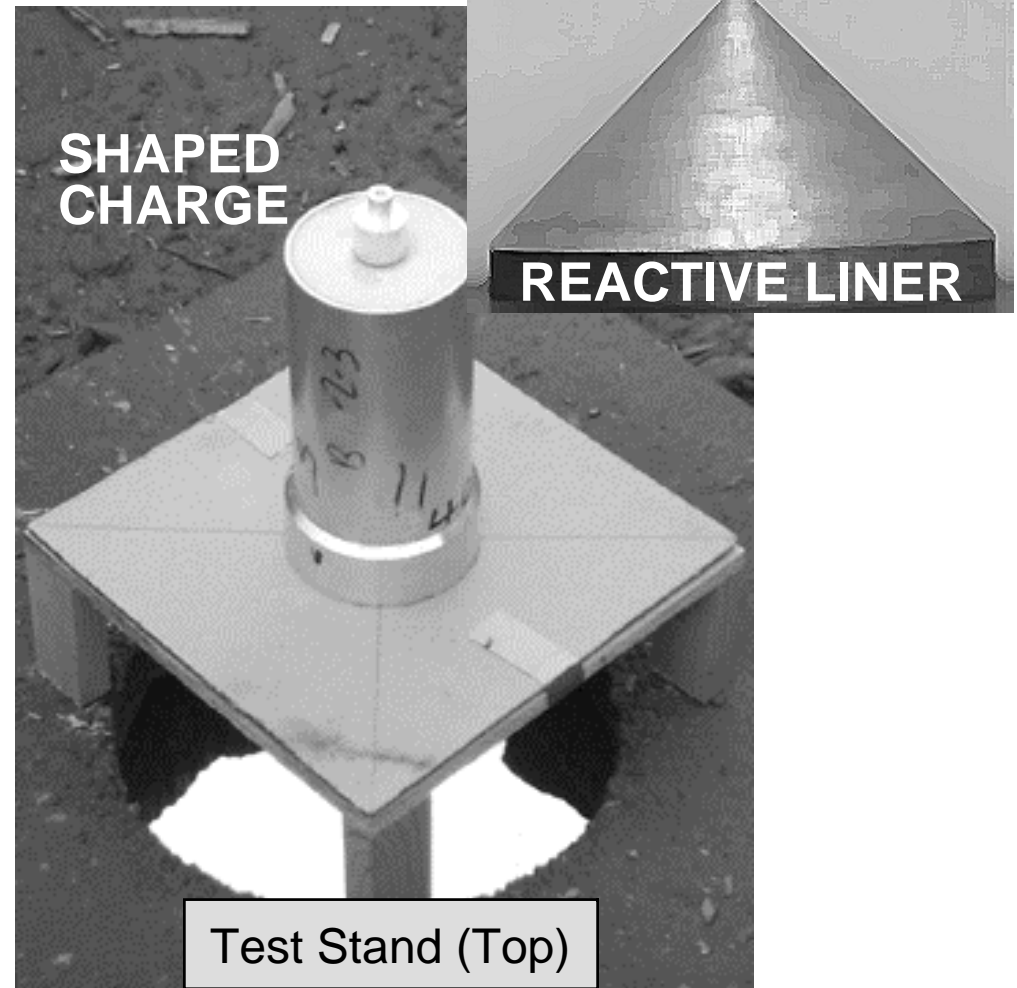
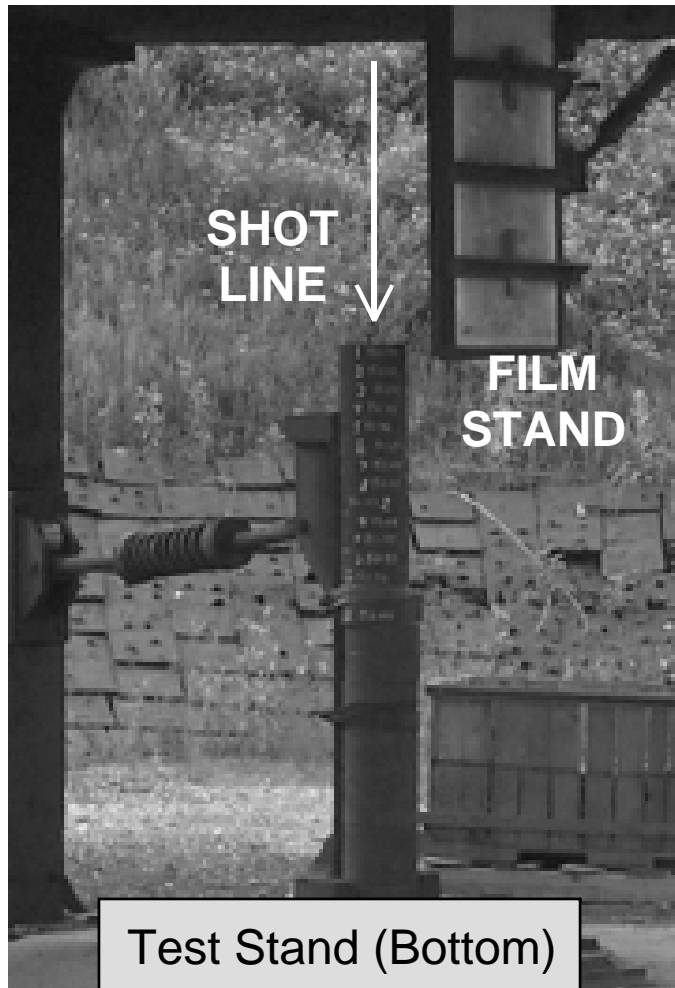
### Final Design





# Unitary Demolition Warhead

## *Jet Characterization*



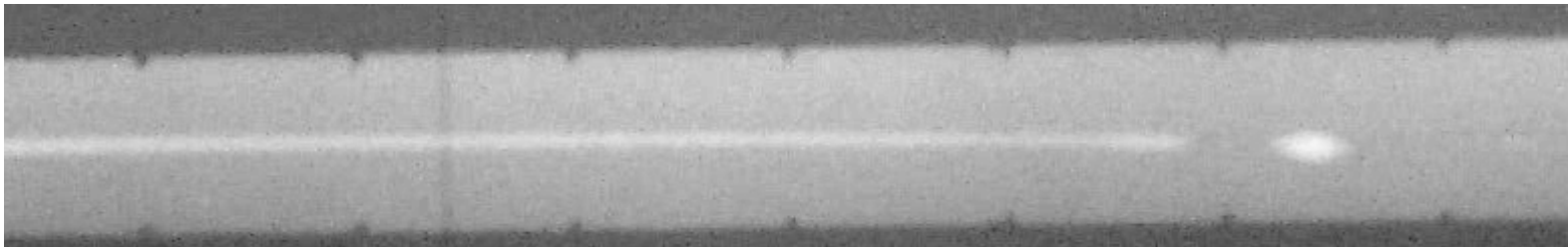


# Unitary Demolition Warhead

## *Jet Characterization*



### **AL 1100-0 Jet (Mass Matched)**



### **Reactive Liner Jet**

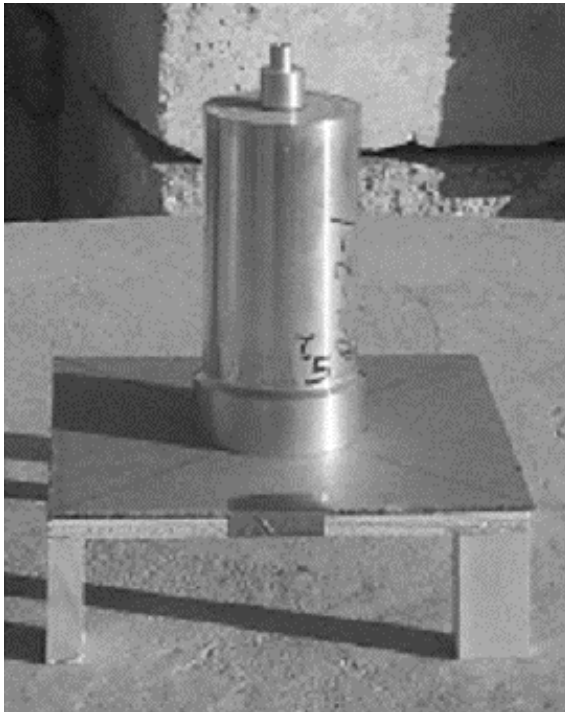


*Very similar!*



# 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**

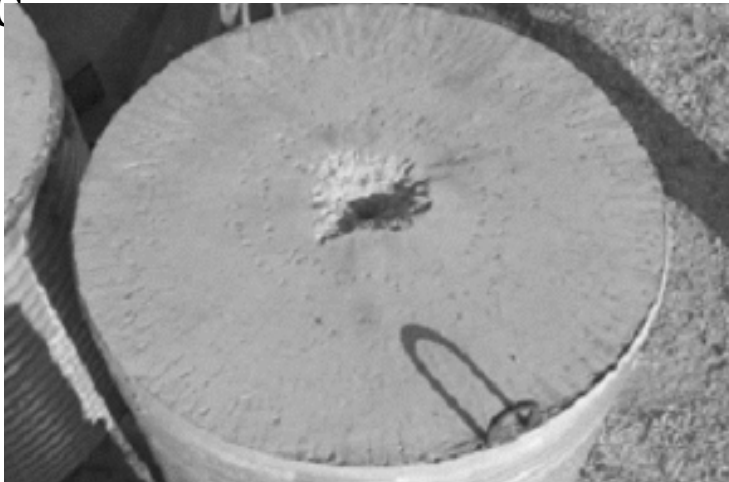
**Target: 152cm diameter X 152cm height concrete**



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# Unitary Demolition Warhead

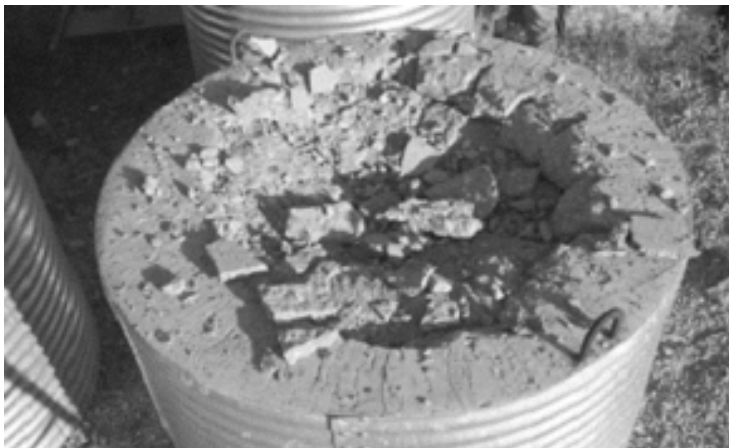
*Target Results: Reactive Material*



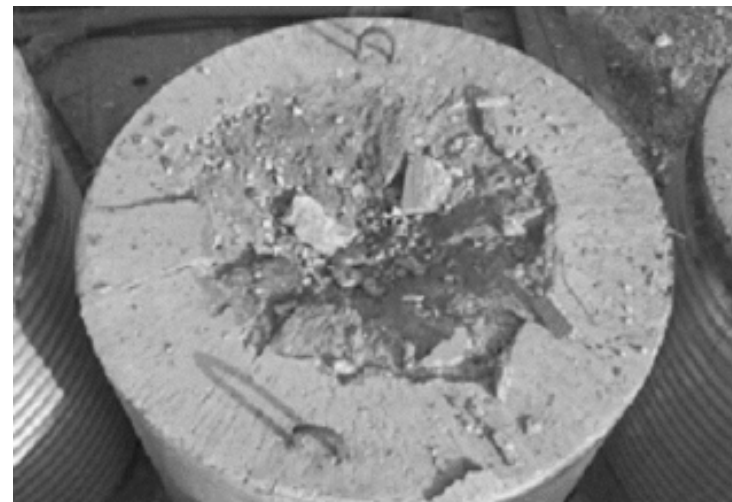
**AL1100-0**



**Reactant Deficient**



**Reactant Balanced**



**Reactant Rich**

*Balanced did most damage!*

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# Unitary Demolition Warhead

## *Radial Cracking*





# Unitary Demolition Warhead

*Target Results: Standoff*



**1/2 Charge Diameter**



**1 Charge Diameter**



**2 Charge Diameters**



***Large performance drop-off at 2 CDs!***

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# Unitary Demolition Warhead

## *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)



# Contact Information

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