



**Current Status of Transportable Controlled Detonation Chambers
(CDCs) Offered by CH2M HILL**

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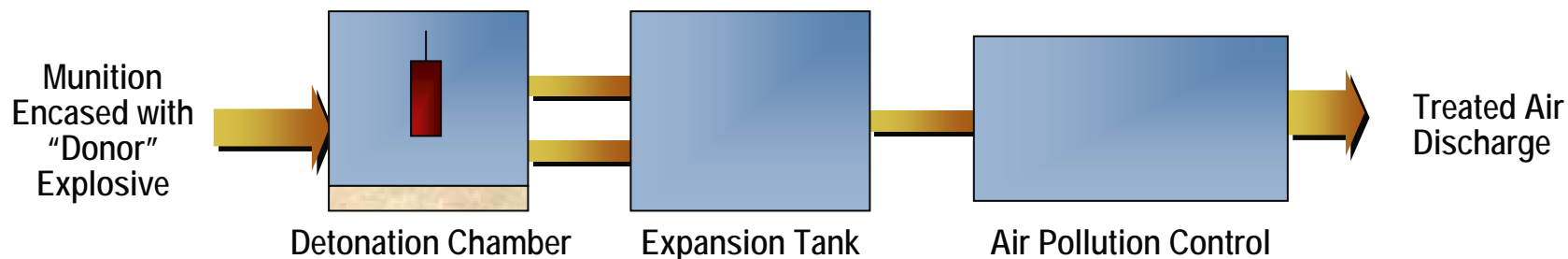
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Outline

- Overview of Controlled Detonation Chamber (CDC) Technology
- Update of Explosives Safety Approval
- Representative Projects

Our CDC Operating Philosophy Overview for UXO Destruction



- Detonation event fractures the munition
- Blast and fragments contained in chamber
- Process has a distinct end point (measureable and verifiable)

- Blast wave dampened
- Quasi-Static Pressure reduction from gas cooling and increased volume

- Based on project requirements

CDC Chambers Meet Appropriate Engineering Standards

- Detonation chamber has a proven multiple layer wall geometry:
 - Inner wall for fragmentation protection is designed for periodic replacement
 - Inner structural wall is supported by a structural frame system and designed for blast response capacity
 - Outer wall provides a “secondary containment” feature
- Relevant standards and guidelines:
 - Department of defense TM 5-1300 guideline
 - American Society Mechanical Engineers Impulse Loaded Code Case (pending): Chambers compliant as of draft
 - American Welding Society
 - American Institute of Steel Construction



Fragmentation Control

- Fragmentation damage controlled by use of replaceable “wear plates” of abrasion resistant steel
- Plate size designed to minimize distortion and allow for selective replacement of individual plates.
- Wear plates shown to last 2,000 shots of high fragmenting munitions (77mm Clark)



CDC Transportable Chambers

Chamber Model	Munition Capability
T-10	105 mm or equivalent
T-25	5-inch (127mm) or equivalent multiple smaller munitions
T-30/60	155mm or equivalent multiple smaller munitions

T-10 Mobile CDC System



- Self contained system that is transported on one trailer
- Destroyed thousands of conventional munitions and explosive components including 20mm and 40mm projectiles, small arms ammunition, 60mm and 81mm mortar rounds, various fuzes and burster charges as well as assorted commercial and military pyrotechnics
- Demonstrated the ability to destroy 105mm HE munitions

T-25/30/60 Mobile CDC Systems



- Self-contained system that is transported on 2 trailers
- Working explosive capacity verified at 43-lbs TNT (T-30)
- Demonstrated by US Navy, Naval Surface Weapons Center, Crane Division to destroy 5-inch projectiles and 155mm projectiles filled with high explosives

A Variety of Donor Explosives Have Been Demonstrated



PETN Sheet



Granular Explosives



Slurry Explosive



Preformed RDX Donor



Results of Donor Explosives

- Fragments from 75 mm projectiles at Spring Valley with a PETN flexible sheet donor explosive wrap
- Use of a granular explosive encasement with 155 mm munition fragments placed on a witness plate for better viewing



Department of Defense Explosives Safety Board Approval

- T-10 CDC can destroy explosives with a net explosives weight of 13 pounds TNT, inclusive of munition explosives content
- Up to 4.3 pounds of propellants are allowed per shot (single, double, or triple base)
- Incendiaries, riot control agents, and smoke producing fills are approved for destruction in the T-10 CDC, up to 105 mm

Department of Defense Explosives Safety Board Approval

- A donor ratio to explosives ratio of 3:1 is required for the destruction of munitions containing White Phosphorus (WP), smoke producing fills, riot agent fills, and incendiary agent fills
- A donor to explosives ratio of 2:1 is required for the destruction of munitions containing propellants
- Bulk explosives can be destroyed with a donor to explosives ratio of 1:1 or less

Department of Defense Explosives Safety Board Approval

- Plasticized WP munition fills are not allowed to be destroyed at this time since there has been no demonstration of this munition fill. Plasticized WP is more prone to developing a skin that prevents the oxidation of phosphorus with air.
- Application of Explosives Safety Submittal is pending for the T-25, T-30, and T-60 CDC systems allowing larger munitions up to a 155 mm projectile.

U.S. Army, Massachusetts Military Reservation

- T-10 CDC system has been used for destruction of recovered conventional munitions on this former military ordnance range
- Over 25,000 munitions have been safely destroyed, from small arms to 105mm projectiles
- The mobile T-10 system has been used on 5 separate deployments over 3 years



T-10 CDC

T-60 Belgium

- Consumable hardface steel plates with bolt attachment after nearly 2,000 munitions
- 77 mm munitions
- Highly fragmenting rounds
- Wrapped in PETN sheet explosive as donor



Destruction of White Phosphorus Munitions

- Camp Navajo Army National Guard Base, Arizona 2004
- Destruction of WP munitions including 57mm, 75mm projectiles and 81mm mortars
- T-10 CDC safely and effectively destroyed all WP munitions including 162 intact 81mm mortars (4.4 lbs. WP)



**Recovered Munitions
Before Destruction**

Four Separate Sites in California March 2005

- T-10 used at Fort Hunter Liggett, Mare Island, Seal Beach, and Camp Roberts
- 28,858 munitions of explosive concern and code H munitions destroyed in 15 days
- Typical throughput is 25 munitions per day



Destruction of Smoke Producing Fills, Riot agent fills, and Incendiary fills

- Redstone Arsenal, Alabama
2005
- T-10 CDC destroyed:
 - multiple CS grenades and 40mm cartridges
 - multiple HC smoke grenades
 - multiple Thermite (TH-3) grenades
- Complete destruction of all items with no visible in-system residue
- Worker exposure monitoring confirmed no special Personal Protective Equipment required for operations



T-10 CDC



Donor wrapped TH-3 grenades

Conclusions

- Durability has been established with a history of safe and effective performance (9 years and continuing)
- Multiple systems available to meet clients critical success factors
- Systems meet all relevant Department of Defense Explosives Safety Criteria
- Smoke producing fills, riot agent fills, propellants, and fills of incendiaries are now approved for disposal
- No liquid waste generated during operations
- Results have been independently validated by U.S. Government



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