Founded in 1981, Over 35 Yrs. Experience
HQ in Salt Lake City, UT USA
Employee Owned, Small Business

Capabilities Include:
- Professional Engineering & Design
- Consulting
- Fabrication/Construction/Installation
- Commissioning/Training
- Permitting

Specialize in
- Demilitarization of Conventional & Chemical Munitions, Rocket Motors, Propellants, Explosives, and Pyrotechnics (PEP)
- Recycling/Conversion of Energetics and Munition Materials
- Thermal Treatment and Combustion Related Systems
- Pollution Control Systems
- Environmental Consulting, Permitting and Restoration
- Machine Design, Robotics, & Disassembly Equipment
- Automation & Controls (In-House Custom Control Panel Shop & PLC/HMI Programming)
- Electrical Systems in Hazardous Locations

We Take Pride in our Record of Safety, Project Cooperation, & Client Satisfaction
Example Projects

- Flashing Furnace (TFF) systems/Contaminated Waste Processors (CWP): Ravenna AAP, Eglin AFB, Hill AFB, Anniston AD, China Lake NWS, Letterkenny AD, Vieques Puerto Rico, Kaho’olawe Hawaii, Old Talon site WV, Albania, Belgium, Australia
- Rotary Kiln Explosive Waste Incinerators (EWI) worldwide, including international facilities in: Taiwan, Germany, Albania, U.K., South Korea, Ukraine, Belgium
- Used our understanding of combustion processes & atmospheric dispersion to consult for NASA on go/no-go launch criteria for space shuttle launches
- RCRA & Air permitting for mfg., demilitarization, & testing facilities
- Turnkey small-scale contained burn facilities for disposal of commercial energetic wastes for numerous private commercial clients
- Turnkey induction heating melt out system for explosives recycling
- Turnkey contained burn systems to dispose of small tactical rocket motors (<50 lbs NEW)
- Turnkey facility to demilitarize flares, reclaiming and recycling high grade magnesium
- Design/build turnkey large scale contained burn system for bulk single base propellant for emergency response removal action at Camp Minden, Louisiana
- Design/build turnkey facility for contained burn of large tactical rocket motors (e.g., MLRS) for U.S. Army at Letterkenny Army Depot, Pennsylvania
- Countless technology evaluation studies, engineering analyses
Demilitarization
Technology Methods

• Destruction/Disposal
  – Thermal Treatment
  – Chemical Neutralization/Conversion

• Recovery/Reuse
  – Energetic Materials
  – Metal Components

• Disassembly/Preparation
Demilitarization Technology Considerations

- Safe
- Effective
- Environmentally Responsible
- Versatile
- Robust
- Simple
- Proven
- Cost
OB/OD: PCAD Model
Products Of Combustion and Dispersion
EDE: Explosive Waste Incinerator

- Versatile workhorse of demil sector

- VERY HIGH THROUGHPUT
  - Lowest Life Cycle Cost

- Handles configured items up to 30mm HE
  - SAA
  - Primers
  - Fuzes
  - Projectiles
  - Initiators, CADs/PADs
  - Bulk PEP
  - Airbag assemblies

- Handles larger munitions, if explosive exposed by munition preparation (e.g. punch grenades, saw large projectiles)

- Discharged metals are suitable for public release (MDAS or old 5x standard) Recycling of steel, brass, lead

- Off Gas Treatment - Tailored to Waste Materials and Local Applicable Requirements
EDE: Explosive Waste Incinerator

Technology Highlights

• Positive Feed System (Bulk Materials)
• Automated Punch/Feed Systems
• Automated Lead Removal/Recovery
• Automated Magnetic Separator
• Heat Recuperator
• Advanced Pollution Controls
  – Afterburner
  – Low-Temperature Baghouse
  – HEPA Filter System
  – SNCR/SCR
    • NOx Reduction
    • Dioxin/Furan Destruction
  – Mercury Removal System
• Advanced Controls: Limits, Warnings, Alarms, Interlocks
Challenges

- Regulatory/Public Perception
  - Cumbersome Permitting Process
  - NIMBY

- APE 1236
  - High operating/maintenance costs
    - Permit constraints
    - QA/QC Inspections
    - Operational Constraints
  - Older Technology
  - Less efficient pollution controls
<table>
<thead>
<tr>
<th>ITEM</th>
<th>Average Feed Rate Items/Hr</th>
<th>Max Feed Rate Items/Hr</th>
<th>NOx (mg/m³)</th>
<th>CO (mg/m³)</th>
<th>TOC (mg/m³)</th>
<th>Dust (mg/m³)</th>
<th>Heavy Metals (mg/m³)</th>
<th>Dioxin/Furan (ng TEQ/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU Directive Limits</td>
<td></td>
<td></td>
<td>200</td>
<td>50</td>
<td>10</td>
<td>10</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>20mm HE-I-T</td>
<td>900</td>
<td>1250</td>
<td>0.2</td>
<td>0.7</td>
<td>0.4</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
<tr>
<td>20mm SAP-I</td>
<td>1200</td>
<td>1250</td>
<td>0.0</td>
<td>2.1</td>
<td>0.4</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
<tr>
<td>7.62mm Ball</td>
<td>22700</td>
<td>25000</td>
<td>0.0</td>
<td>1.3</td>
<td>0.3</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
<tr>
<td>12.7mm API</td>
<td>5000</td>
<td>6600</td>
<td>40.0</td>
<td>0.1</td>
<td>1.1</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
<tr>
<td>PD Fuze M51 w/Booster</td>
<td>400</td>
<td>400</td>
<td>0.4</td>
<td>0.9</td>
<td>0.5</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
<tr>
<td>TNT Block</td>
<td>89 kg/hr</td>
<td>120 kg/hr</td>
<td>2.6</td>
<td>0.7</td>
<td>0.4</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
<tr>
<td>Bulk M6 Propellant</td>
<td>66 kg/hr</td>
<td>90 kg/hr</td>
<td>0.4</td>
<td>1.7</td>
<td>0.4</td>
<td>N/D</td>
<td>N/D</td>
<td>N/D</td>
</tr>
</tbody>
</table>
El Dorado Engineering
Turnkey Belgium EWI - INES

Recovered Value from Recycled Metals

<table>
<thead>
<tr>
<th></th>
<th>steel</th>
<th>brass</th>
<th>lead</th>
<th>mixed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>€ 10,291</td>
<td>€ 422,272</td>
<td>€ 35,174</td>
<td>€ 39,295</td>
<td>€ 507,032</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ 598,298</td>
</tr>
</tbody>
</table>


EDE: Flashing Furnace Technology
Transportable Flashing Furnace: TFF

- Fully Transportable
- Thermally Decontaminate material to 5X
- Rate: 2 tons/hr explosive cont. metal
- Quick heat up/cool down cycle
- Rolling Hearth (Car Bottom)
- Max. Load: 10,000 lbs
- Combustion Design to minimize emissions
- Strongbox used to pop live items
- Safety: remote control pendant
- Designed to survive unplanned explosions
- Off Gas Treatment Options
Contaminated Waste Processor
Example EDE Applications

• Kaho‘olawe Island, HI
  – >12 million lbs range scrap UXO reclamation project

• Anniston Army Depot
  – Used to treat rocket motor bodies from missile recycling center prior to metals recycling

• Eglin Air Force Base
  – SAA: .5.56, 7.62, & 9mm, 12 gage, .50 & .30 cal, 20mm & 30mm TPT, CADs/PADs

• Hill AFB
  – 20mm & 30 mm TPT, misc. UXO, and range scrap

• Talon WV Cleanup (MARID)
  – Treated >50 different types of live fuze components

• Letterkenny Army Depot
  – SAA: 5.56mm, 7.62mm, 9mm, .50 cal, .30 cal,

• Ravenna Army Ammunition Plant
  – remediation operations: PEP contaminated eqpt.

• Other Locations include: China Lake, Puerto Rico, Mexico, Albania, Ukraine, England, Belgium
TFF-EM - Talon Cleanup Items

**Variety:** (M524, M532, M521, M501, MK27, M524, M577, M513, MK90, M572, M48, M125A1, etc)
- Detonators
- Rotors
- Delays
- Plungers
- Leads
- Tracer

**Energetics:**
- Tetryl,
- RDX,
- PETN
- Pb Azide,
- Pb Styphnate
Talon Cleanup, West Virginia

Hazardous Mess

Safe and Clean
Hill AFB Application

- Established batch limits
  - 25 lbs NEW
  - No mass detonating materials

- Startup Testing
  - Determine load rates
  - Confirm treatment times

- Load Rates & Configurations:
  - 150 lbs 20mm AUR TPT (25 lbs NEW)
  - 450 lbs AUR mix & 1400-2000 lbs brass
  - 2000-3000 lbs steel & 2000 – 3000 lbs steel

- Material Disposition
  - Brass recycled
  - Low value steel landfill
Contained Burn Technology

- Bulk Propellant, Explosives
- Tactical Rocket Motors
- Igniters, Detonators
- PEP Contaminated Waste
- Air Bag Propellants
Contained Burn Technology
Highly Scalable

10 Pounds per Burn Cycle

50,000 Pounds per Burn Cycle
EDE Contained Burn Technology

Example Applications

Small Tactical Rocket Motors (2 Projects)
- Small Tactical Rocket Motors (<20 lbs propellant)
- Design Throughput: >40 motors per day
- Multi Stage (dual grain) double based propellant
- Dry scrubber PAS (OGT) for particulate

Ammonium Perchlorate Rocket Motor Demil (ARMD)
- Flexibility for Wide Variety of Tactical Rocket Motor Types
- 60 – 1605 lbs propellant per RM
- Design throughput: 2-3 motors per hour (dependent on size)
- Off Gas Treatment for HCl, particulate, and dioxin/furan
- Full-Scale demonstration performed for:
  - MLRS (216 lbs NEW) and PHX (365 lbs NEW)
- Production Facility Under Construction, Startup Spring 2016

Camp Minden M6/CBI Bulk Propellant
- Throughput >15 million lbs of M6 propellant and CBI in One Year
- Off Gas Treatment similar to Belgium EWI
- Emergency Response: Design/Build < 8 months
- Production Facility Under Construction, Startup Spring 2016
AP Rocket Motor Demilitarization (ARMD) Project

- Large Workload
  - 60 to 1605 lbs Propellant/Motor
  - Challenging Chemistry

- Thorough Technology Evaluation
  - Non Open Burning
  - Numerous Stakeholders

- Contained Burn Selected

- Construction Completed
  - Letterkenny, PA
  - DDESB Approval Received
  - RCRA Permit Approval Received
  - Air Permit Approval Received
  - First Stack Test Completed (Sidewinder)
PROCESS DESIGN

• RM’s are placed on firing stand
• RM’s are remotely loaded into system
• Remote automated chamber sealing with ignition interlock
• RM’s are static fired intact
• Propellant burns as designed
• Gases are contained in chamber
• Gases cool and are metered through economical pollution abatement system
ARMD Production Facility Design
ARMD Sidewinder Motor Environmental Test Results

Stack Emissions
- Total Particulate = 0.006 gr/dscf (Relevant Limit = 0.04 gr/dscf)
- HCl = < 2.4 ppm
- Opacity = 0%, no visible emissions

Neutralized Brine
- Passes TCLP
- Perchlorate Non-Detect
- Non-Hazardous Material

Alumina Solids (Filter Cake)
- Passes TCLP
- Perchlorate Non-Detect
- Non-Hazardous Material
Camp Minden Project

Challenge:

• Intense Public Scrutiny
• First-of-a-Kind Facility
  – Extremely High Throughput
  – Ultra Low Emissions
  – Safety Considerations are Paramount
• Safely Destroy Approximately 15.7 Million Pounds of Propellant <1 year after startup
• Design, Build, Commission in < 9 Months
Camp Minden
Contained Burn System Concept
Camp Minden
Contained Burn System Facility

- < 9 Months After Contract Award - First Burn
- Within 4 days - Commence 24/7 operations
Camp Minden
Contained Burn System

- Process Rate: 880 lbs. M6 per Cycle (20-25 minutes)
- After Loading Tray All Operations are Remote for Safety
- Facility Designed to Operate 24/7
- Safely Destroys 50,000 – 60,000 lbs. per day
Camp Minden
Contained Burn System

• Remote Controls: PLC, HMI, CCTV
• Redundant Safety & Environmental Interlocks
Camp Minden
Particulate Removal

Particulate Removed From Exhaust Gas Collected For Safe Recycling/Disposal
Camp Minden
Contained Burn System

Stack Emissions Testing

- VOCs: Allowable 10 ppm, actual <0.01 ppm
- CO: Allowable 20 ppm, actual <0.01 ppm
- NOx: Allowable 250 ppm, actual <0.01 ppm
- All POHCs: Non detect
- DRE >>99.999%
- PM: << 0.0016 gr/dscf
- No Visible Emissions
April 2017: Facility has Safely Disposed of All Propellant
Approximately 15.7 million lbs. Safely Destroyed in < 1 yr.
Emissions Well Below Allowable Levels
Safe/Simple/Reliable
Environmentally Responsible Solution
Disassembly Equipment

- Projectile Saws
- Rocket Motor Segmenting
- Bomb Segmenting
- Pull-Apart Machines
- Debanding/Defusing/Depriming
- Shear Machines
PEP Washout & Meltout Systems

- Autoclaves
- Explosive Flaker Belts
- Hot Water Washout Plants
- High Pressure Water Jet Technology
- Slug Out (no steam contamination)
Microwave Meltout

- Demonstration Optimized for 750 lb bombs
- Little contamination
- Yields higher value explosive product
Magnesium Recovery Prototype Plant
MRPP

- 60mm through large LUU2 flares
- 300 pounds per day

Process Steps
- Candle Preparation and Washout
- Refining Process Yields High Purity Mg
  - Separation
  - Polishing
  - Rinsed
  - Classified
  - Dried
  - Packaged For Shipment
Alternatives to OB/OD
Summary

Primary Drivers
- Safety
- Proven, Robust, Versatile
- Throughput
- Cost
- Recycling: Economics/Logistics
- Permitting
- Acceptance