Presented to:

20th Annual Global Demilitarization Symposium

Missile Demil Integration Efforts

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AMRDEC

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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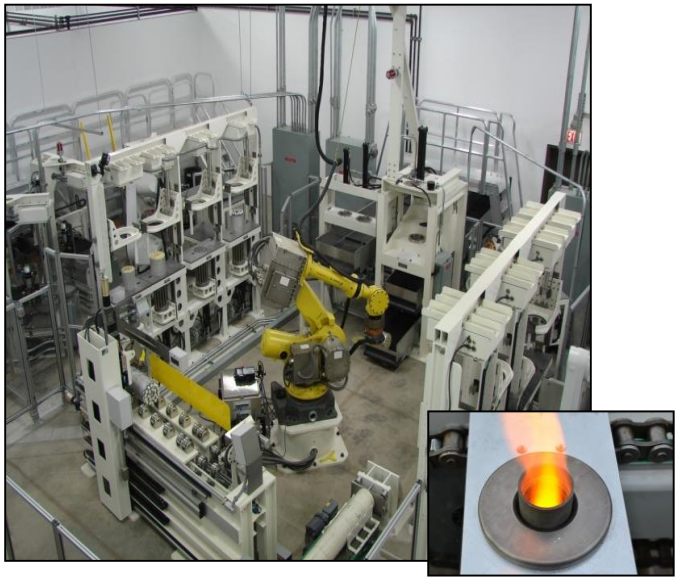
Acknowledgements

Missile Demil Integration Efforts

- Letterkenny Munitions Center (LEMC) Ammonium Perchlorate Rocket Motor Destruction (ARMD) Capability
  - Closed thermal Destruction of Army and OSM rocket motors containing AP propellant
  - Addresses ~28 different rocket motor systems

- Anniston Munitions Center (ANMC) MLRS Warhead Processing Capability
  - Automated Warhead Disassembly and closed thermal destruction of MLRS M77 Grenades



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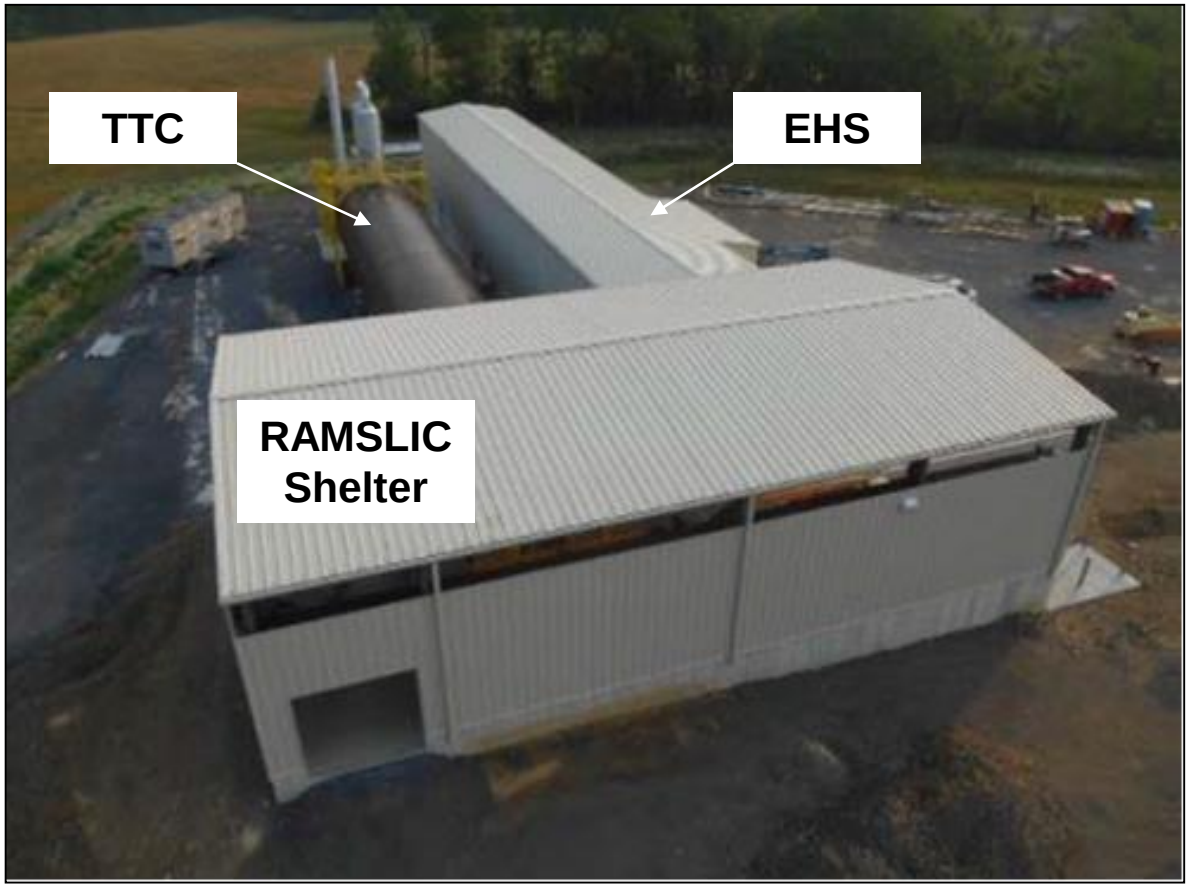
Team Members

LEMC ARMD

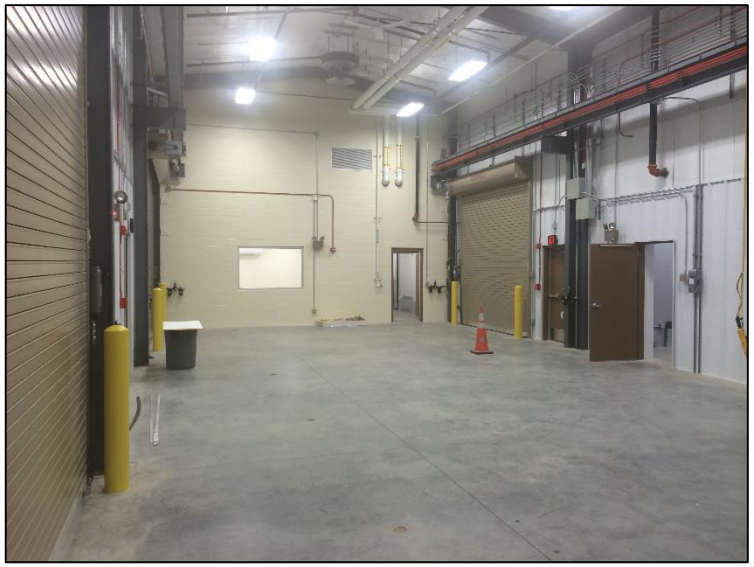
- ARMD plant designed to process 10,000 rocket motors annually
  - Provides conditions for complete combustion
  - Collects particulate matter and treats hydrochloric acid (HCl)
  - Thermal Treatment Chamber dimensions are ~19 ft. Diameter by ~115 ft. long
  - Designed to process full-up rocket motors up to 680 lbs net explosive weight (NEW) and motor segments up to 800 lbs NEW
  - Flexibility to address ~28 different rocket motor systems

- ARMD Capability houses five main facilities:
  - Motor Preparation Building
  - Thermal Treatment Chamber (TTC)
  - Remote Automated Sealing, Loading, & Ignition circuit (RAMSLIC) Shelter
  - Pollution Abatement System (PAS)
  - Effluent Handling Shelter (EHS)

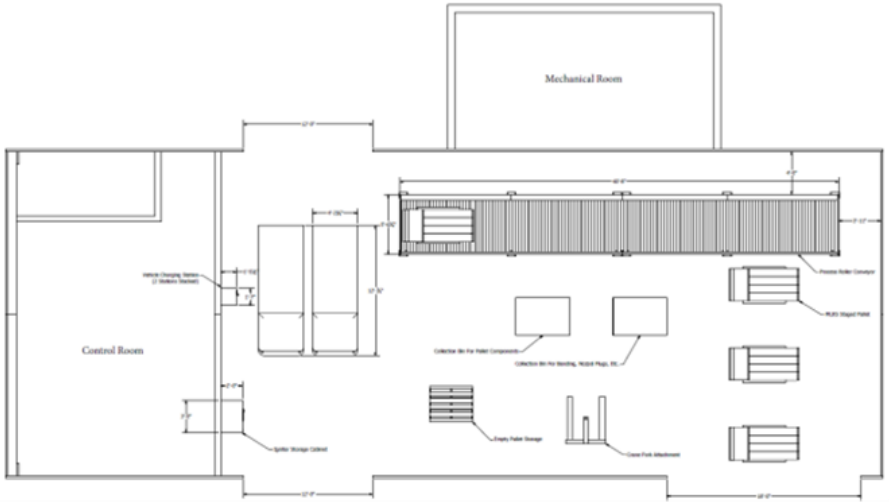
Main TTC Structure



Motor Preparation Building



- Prepare motors for firing and install ARMD igniter
- Remove packaging, environmental seal, unnecessary hardware
- Major Components:
  - Control Room
  - 5-ton Bridge Crane
  - Rocket Motor Conveyor System



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Remote Automated Motor Sealing, Loading & Ignition Circuit Completion (RAMSLIC)

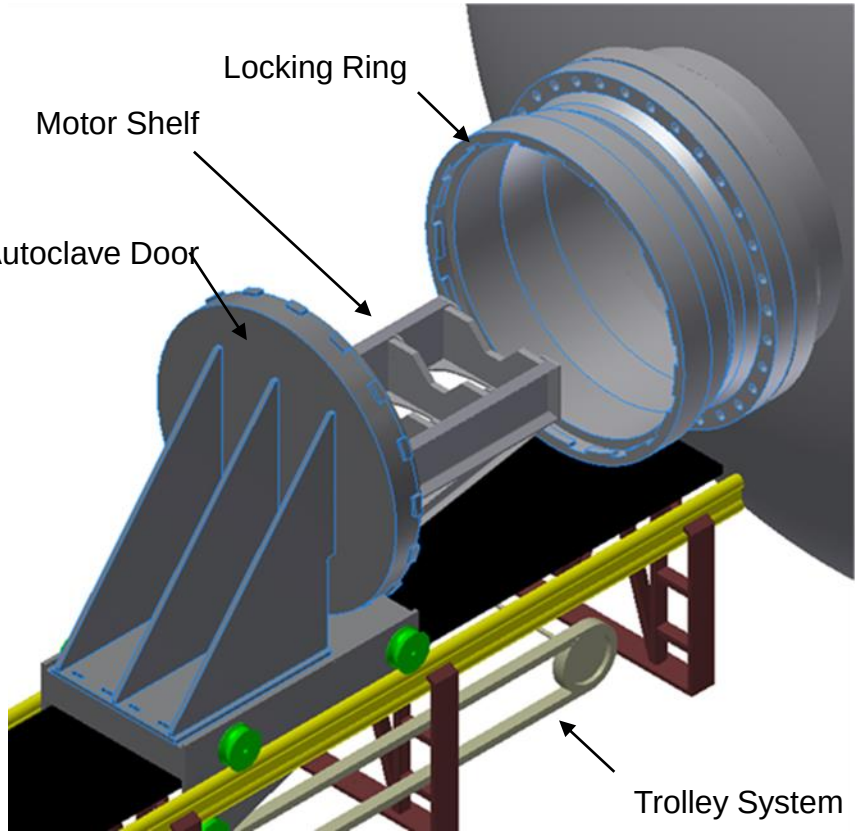
- The RAMSLIC facilitates the safe loading, firing and unloading of rocket motors into the TTC
- The RAMSLIC is located in a shelter at the end of the TTC
- Roll-off bins for disposal of fired cases located nearby
- The RAMSLIC consists of:
  - Trolley System and Trolley Base
  - Autoclave Door with Locking Ring
  - Motor Shelf
  - Two 5-Ton Bridge Cranes
  - Spent Case Bins
- Prototype RAMSLIC demonstrated with various motors at China Lake testing

Prototype RAMSLIC at China Lake

Remote Automated Motor Sealing, Loading & Ignition Circuit Completion (RAMSLIC)

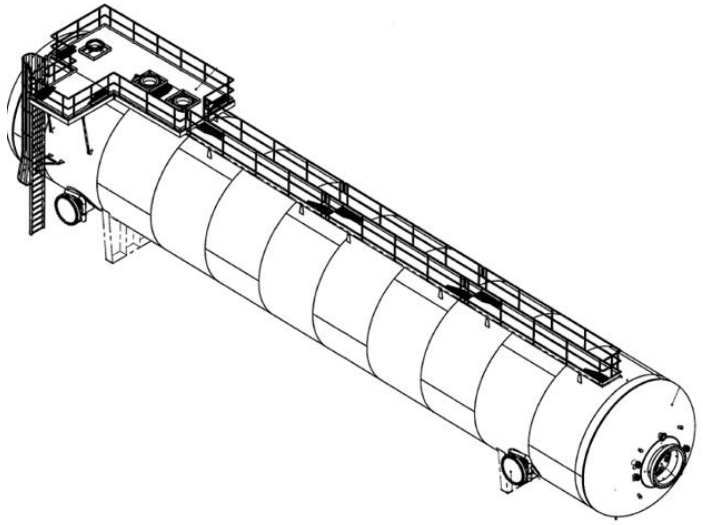
RAMSLIC Shelter

RAMSLIC



Thermal Treatment Chamber

- The TTC is a 19’ OD x 115’ L pressure vessel with 1” thick walls and elliptical heads (~30,000 cu. ft. internal volume)
- The TTC provides conditions for completion of combustion and captures exhaust gases until release into the PAS
- Nozzle system contained within vessel washes down walls and floor to flush out settled particulate and residual HCl as required
- TTC has a working pressure of 150 psi and a burst pressure of 250 psi
- TTC features:
  - Two 24” burst disks rated at 137 – 150 psi
  - Two 36” access ports
  - Vent Valve located at the far end
  - Specialized coating (high nickel alloy)
  - Internal sacrificial shielding for potential deflagration events

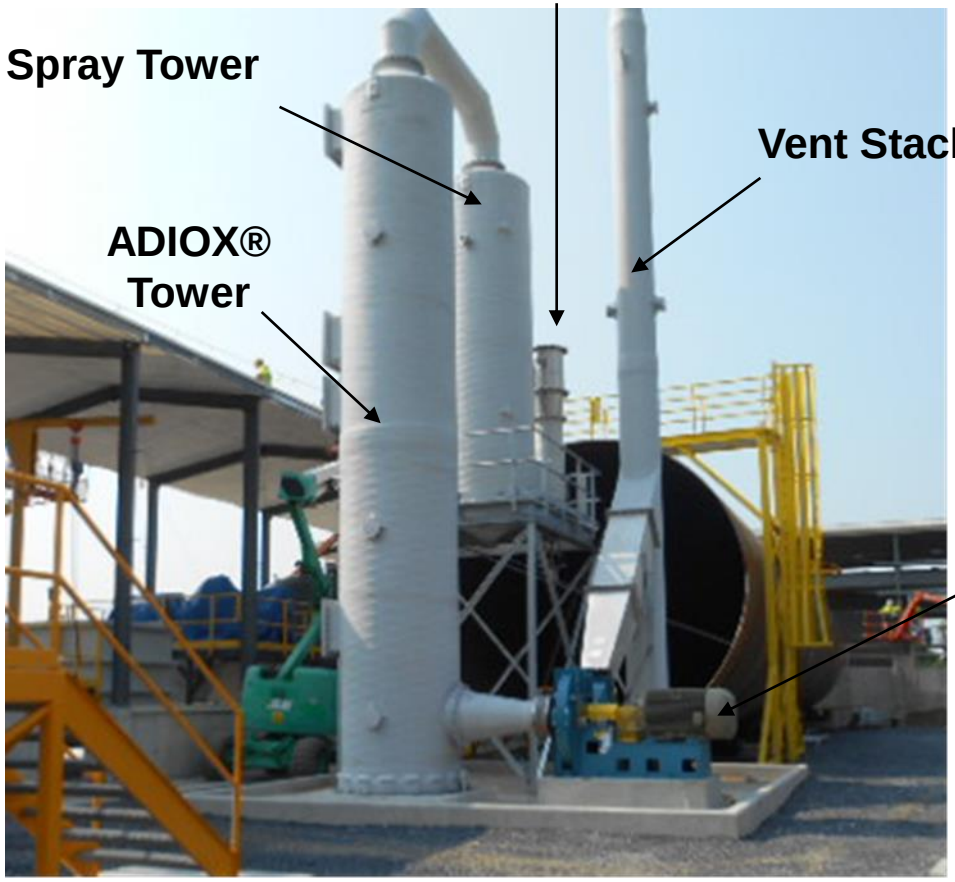


Thermal Treatment Chamber

Pollution Abatement System (PAS)

- All exhaust gases captured in the TTC are pulled through the PAS at a controlled rate via an induced draft fan
- Wet scrubber technology utilized to remove HCl and particulate
- Magnesium Hydroxide used as HCl neutralizing agent
- The PAS major components are:
  - Venturi Scrubber
  - Spray Tower
  - Packed Bed Scrubber Tower (ADIOX® Tower)
  - Induced Draft Fan
  - Vent Stack
- Prototype PAS demonstrated in motor firings at China Lake at greater than 95% reduction in HCl, 98% reduction in particulate, and 99% reduction in dioxins and furans
- The ARMD and associated PAS are permitted by the Pennsylvania Department of Environmental Protection (PADEP)

Pollution Abatement System

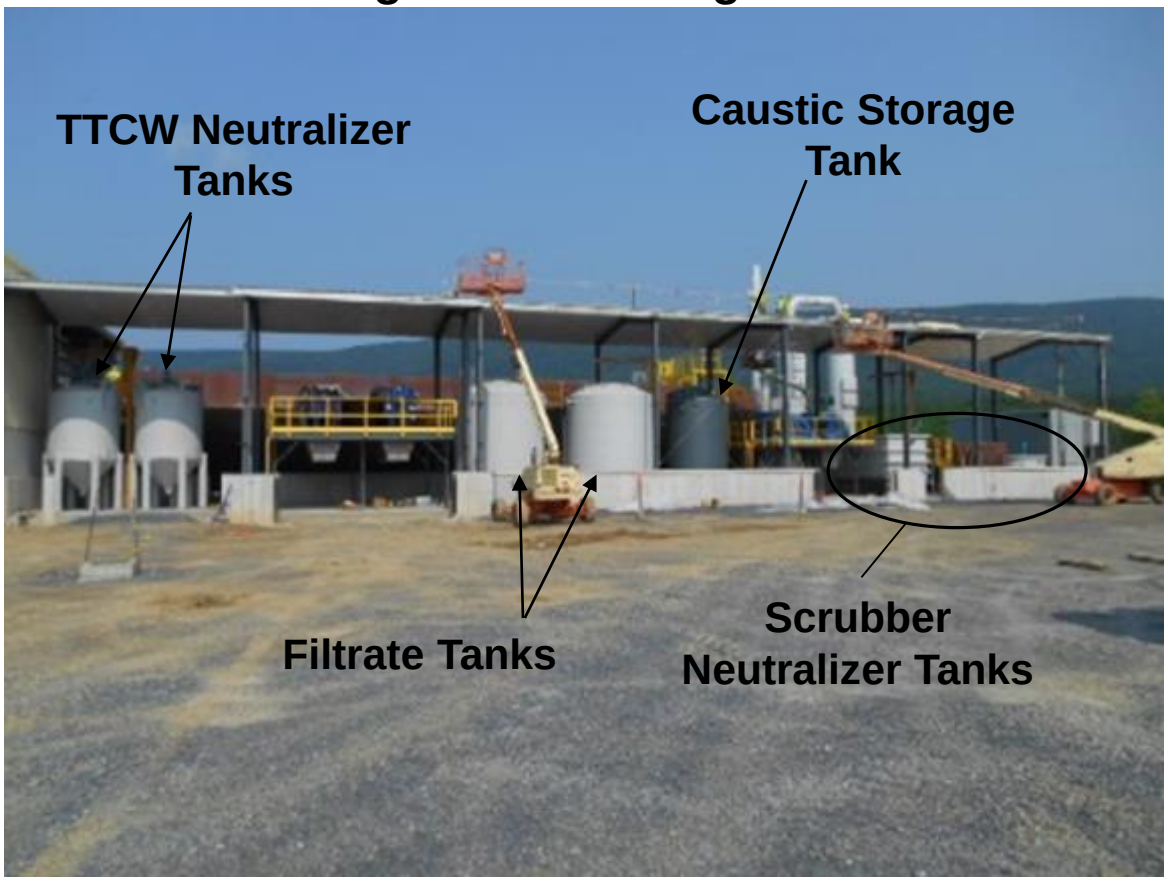


Effluent Handling System (EHS)

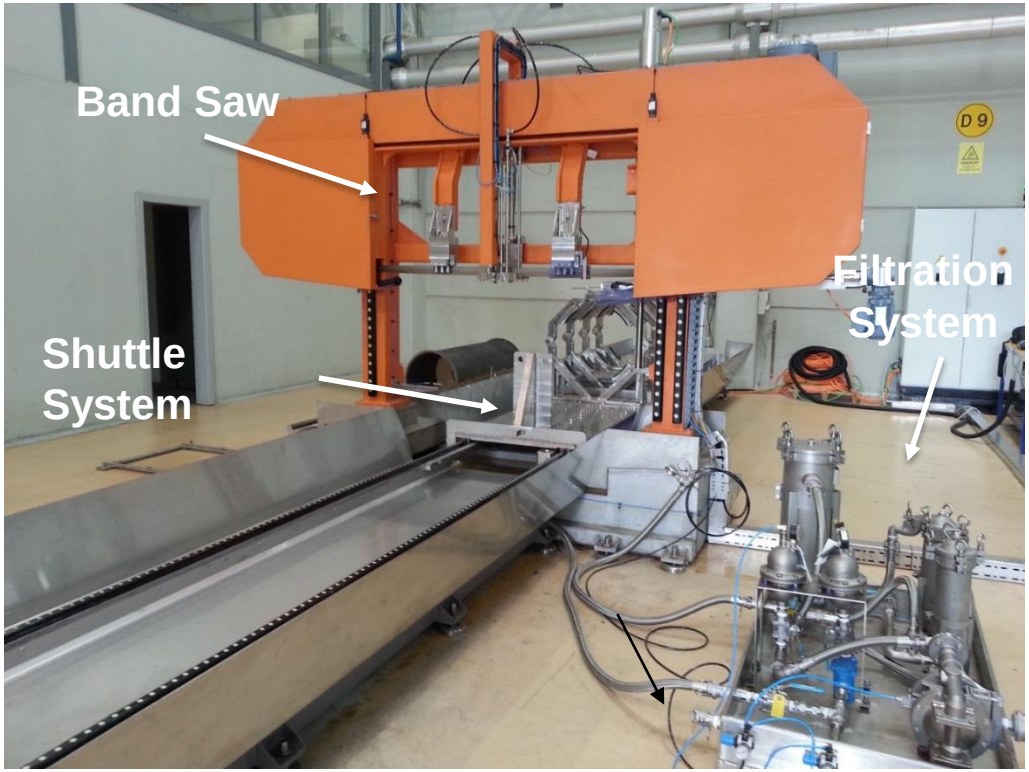
- The EHS is designed to:
  - Filter/collect particulate
  - Neutralize/filter all brine that is used in the thermal treatment chamber wash (TTCW) system and the PAS
- Consists of two systems linked through the common use of brine:
  - TTCW System
  - Scrubber Neutralizer System
- Major components:
  - TTCW Neutralizer Tanks
  - Filter Presses
  - Filtrate (Brine) Tanks
  - Caustic Storage Tank
  - Scrubber Neutralizer Tank
  - Scrubber Clarifier
  - Scrubber Recirculation Tank

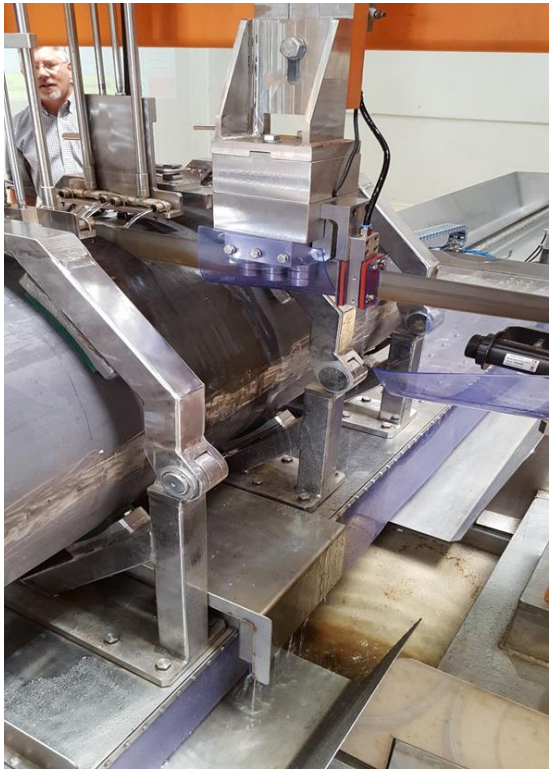
Effluent Handling System

Effluent Handling Shelter during construction



Rocket Motor Segmenting

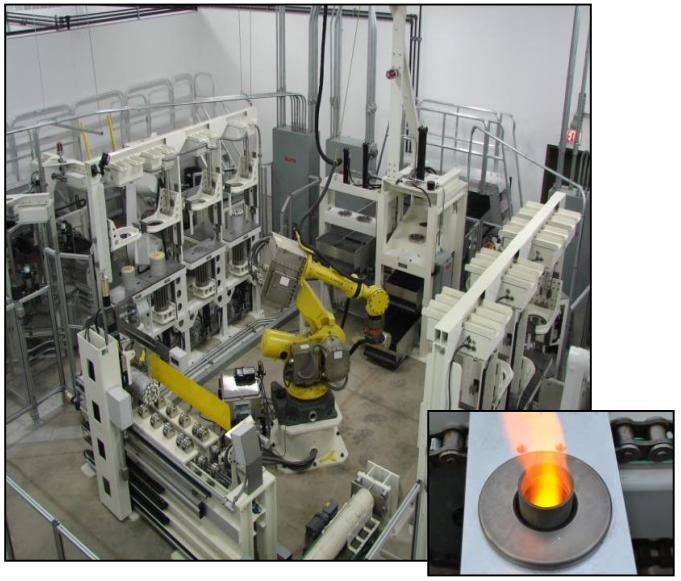




- Rocket Motor Segmenting Capability being developed in order to downsize larger motors
- Largest segment planned for TTC is 805 pounds net explosive weight
- The Water-Cooled Band Saw has completed factory acceptance testing and is scheduled for final testing in early 2016

Missile Demil Integration Efforts

- Anniston Munitions Center (ANMC) MLRS Warhead Processing Capability
  - Automated Warhead Disassembly and closed thermal destruction of MLRS M77 Grenades



Team Members

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Warhead Processing Facility

Automated Disassembly of MLRS Warheads

- Warhead Input Station
- Chipless Machining Center
- Grenade Removal Stations
- Grenade Placement Station
- Grenade Fuze Removal Station

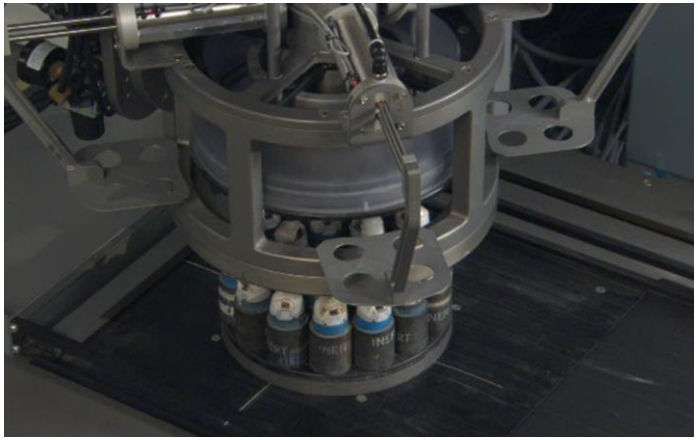
After Warhead disassembly:

- De-fused grenades
- Pulled fuses
- Empty foam packs
- Empty warhead skins

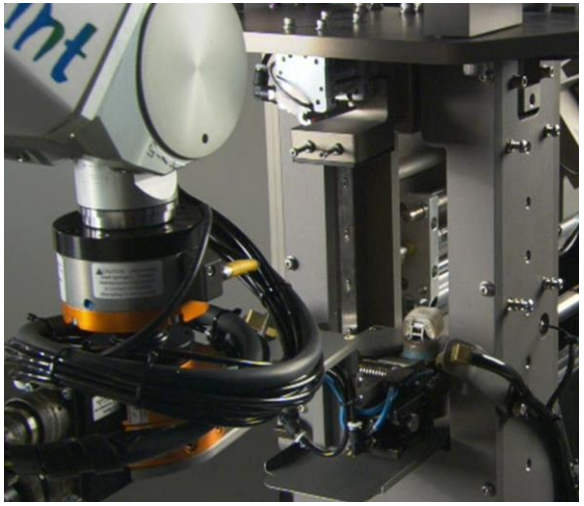
Warhead Processing Facility

Grenade Removal Station

Grenade Removal Tool



Grenade Placement Station



Fuse Removal Station

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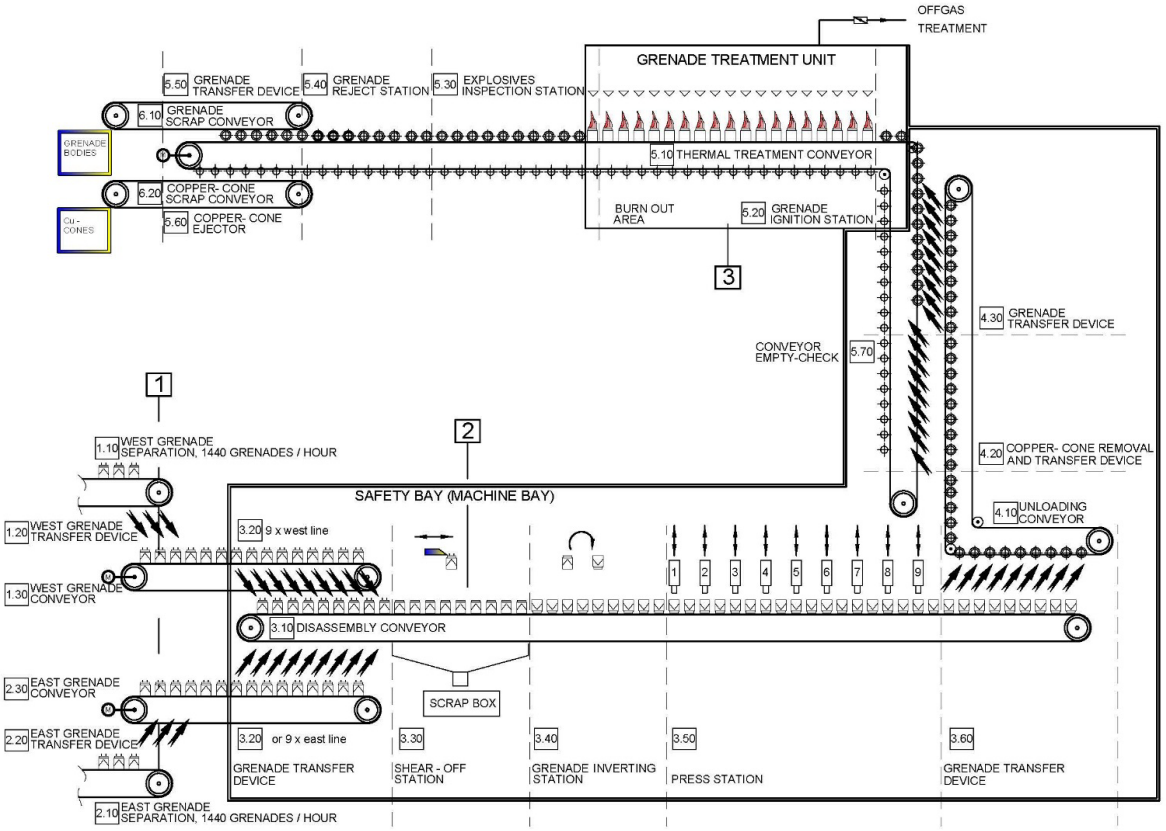
Thermal Treatment Closed Disposal Process (TTCDP)

- **M77 Grenade Thermal Treatment Closed Disposal Process (TTCDP)**
  - **Automated operations to dismantle the grenade**
  - **Thermally treats energetics in the grenades and fuses**
  - **Results in empty grenade bodies and copper cones**
  - **Processing rate of 2,880 grenades per hour**



TTCDP System Flow

The TTCDP consists of the following Stations:

- Shear Off Station
- Grenade Inverting Station
- Press Station
- Copper Cone Removal Station
- Grenade Transfer Device
- Grenade Ignition Station
- Explosive Inspection Station
- Off Gas Treatment
- Scrap Collection

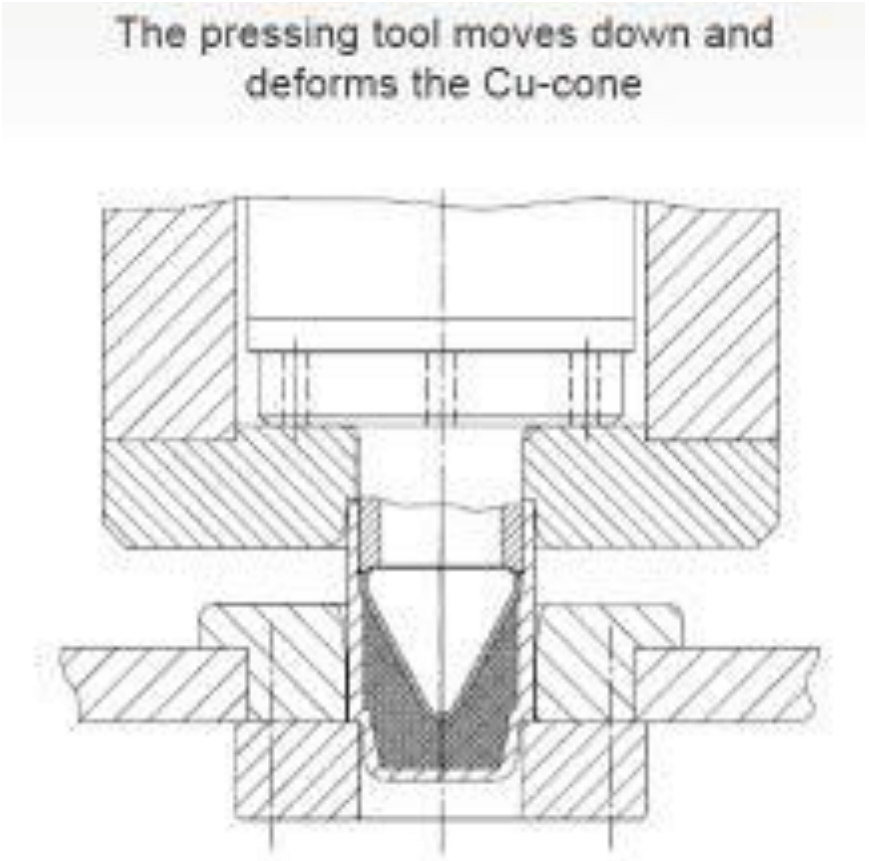
Thermal Treatment Closed Disposal Process (TTCDP)

Shear Off Station

Grenade Inverting Station

Thermal Treatment Closed Disposal Process (TTCDP)

- The grenade body is centered and pressed down into the mold of the disassembly conveyor.
- The copper cone press-tool which is attached to a hydraulic cylinder, runs into the grenade body and deforms / loosens the copper cone
- After the pressing operation. The copper cones are loose inside the grenade body.



Thermal Treatment Closed Disposal Process (TTCDP)

Copper Cone Removal Station

- The copper cones are retracted by mechanic inside grippers that pull the copper cone out of the grenade body.
- The copper cones are then placed in holder above the empty grenade bodies

Grenade Transfer Device

- Checks for copper cones in the grenade body
- Automatic reject of grenades with copper cone
- Transfer of grenades without copper cone into the thermal treatment conveyor

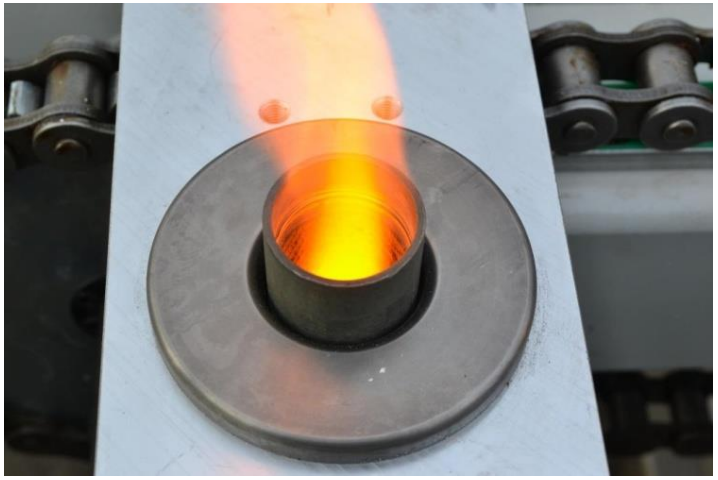
Thermal Treatment Closed Disposal Process (TTCDP)

Grenade Ignition Station

- Grenade ignition is done by electric heated coils that are moved into the grenades.
- A set of 9 grenades is ignited simultaneously
- The off gasses will be processed through the HEPA filter system

Explosive Inspection Station

- Each grenade is checked by 2 separate probes for explosives by mechanic check cylinders at the end of the thermal treatment conveyor.



Grenade Fuze Thermal Treatment

- The fuze assemblies will be automatically conveyed from the fuse removal system to the Munitions Destruction System (MDS)
- The MDS utilizes indirectly heated armored chamber to process fuses
- The MDS will be emptied at predetermined times and the scrap recovered
- The off gasses will be processed through the HEPA filter system

Summary

- **Letterkenny Munitions Center (LEMC) Ammonium Perchlorate Rocket Motor Destruction (ARMD) Capability**
  - TTC fabrication currently scheduled for completion 2nd QTR FY16
  - Acceptance testing for the five families of rocket motors scheduled to begin 4th QTR FY16
  - Full rate production scheduled for FY17

- **Anniston Munitions Center (ANMC) MLRS Warhead Processing Capability**
  - Warhead Processing checkout has been completed
    - 700 warheads successfully processed
  - Factory Acceptance Testing completed in Germany for the M77 TTCDP equipment
  - Equipment is onsite at the ANMC awaiting installation
  - Building facilitization commenced 1st QTR FY16
  - Full System LRIP is scheduled to begin 4th QTR FY16.

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