Demilitarization

Design for Demil Efforts at GD-OTS




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DEMIL

GD-OTS Large Caliber Ammunition Product Portfolio

120mm Tank Ammunition

105mm and 155mm Artillery

Guided Projectiles

Mortar Weapons

Coalition Supply and Support Services (CS3)

Expeditionary Fire Support System

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Pipe Joints

Demil

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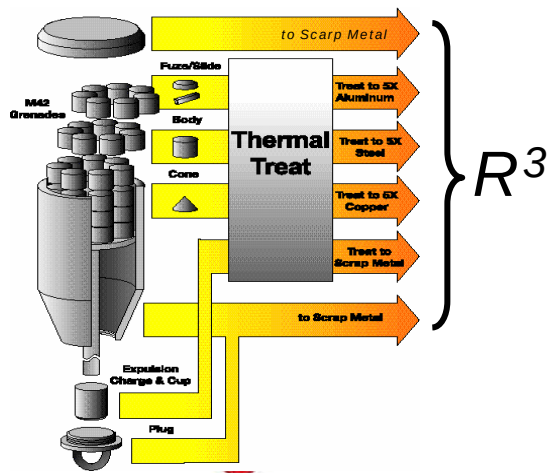
GD-OTS – Commercial Demil Prime Contactor

- General Dynamics (GD) has been involved in Demil work since mid 1980s
- Since 1999 GD Ordnance and Technical Systems (GD-OTS) is a Systems Contractor for the US Army
  - 5 year program with 43,000 ton ammunition disposal
  - Approximately 600 tons per month processed at various facilities
- Since 2005 GD-OTS is a Demil Sole Source Systems Contractor to US Army
  - Currently 4 years, 106,000 tons ammunition
  - 2,350 tons per month average
  - 4,550 tons – highest month to-date



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WHY DEMIL?

Life Cycle Need for Demilitarization

- **Weapon Platforms and ammunition have a life-cycle, become obsolete, and end up in the Demil Stock Pile**
- **Demil stocks decay and create hazards, environmental, and security problems**
- **Disposal cost continue to increase with changes in environmental regulations**
- **Demil is the only storage solution that creates space in the depots**


Corroded Projectiles


Corroded Cartridges


Corroded Projectile

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Practical Reasons for Demilitarization

- Demil stocks impede the depots' wartime support mission
- Tax Payers are spending lots of money to secure, maintain and inventory obsolete ammunition
- Obsolete Ammunition is occupying covered storage space at key ammunition out load depots
- Demil stocks occupy space inefficiently
- Stability of propellant and energetics a long-term safety hazard

Store, Secure, Maintain and Inventory obsolete Ammunition is a Waste of Money and Resources

Impacts to Demilitarization

- **Political pressure can restrict or eliminate use of many ammunition items**
  - **Cluster Ammunition**
  - **Depleted Uranium**
  - **“Dumb” Ammunition**
  - **Suspected Carcinogens**
- **Environmental impact**
  - **Sea dumping**
  - **Open Burn**
  - **Open Detonation**
  - **Land Filling**

Loaded Ammunition Projectiles

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DEMIL REQUIREMENTS

Demil Environmental Requirements

- **Open Burn / Open Detonation is not an option – only available to USG Depots and becoming obsolete**
- **Must meet all local, state, and federal environmental regulations**

➔ **adds cost to demil process**

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Demil Requirements

- **Many demil processes require state-of-the-art technologies to deal with ammunition designs from 25-50 years ago**

  ➔ **adds cost to demil process**

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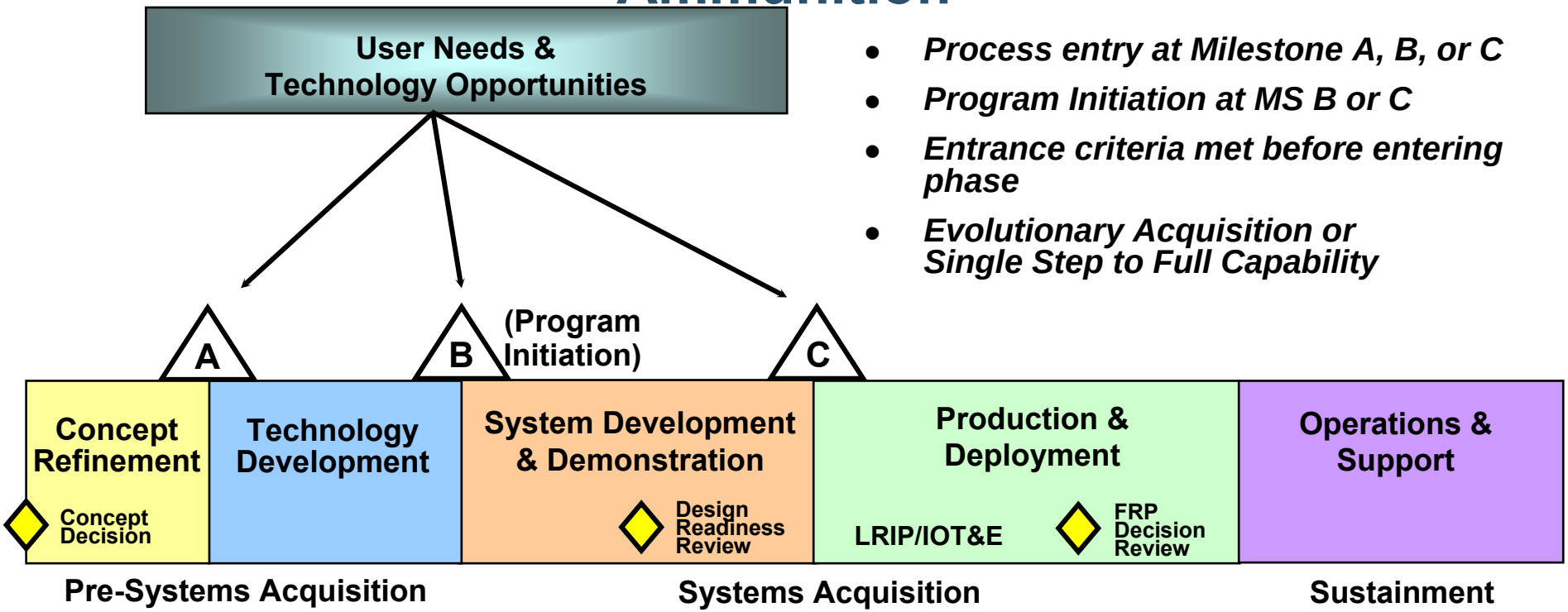
Typical Program Life Cycle for Conventional Ammunition



- *Process entry at Milestone A, B, or C*
- *Program Initiation at MS B or C*
- *Entrance criteria met before entering phase*
- *Evolutionary Acquisition or Single Step to Full Capability*

Historically, Demil has <u>not</u> been considered part of the Life Cycle

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Design for Demil

- Demil needs to part of the systems engineering throughout the ammunition design and production phases to reduce overall life cycle cost

Design for Demil Challenges:

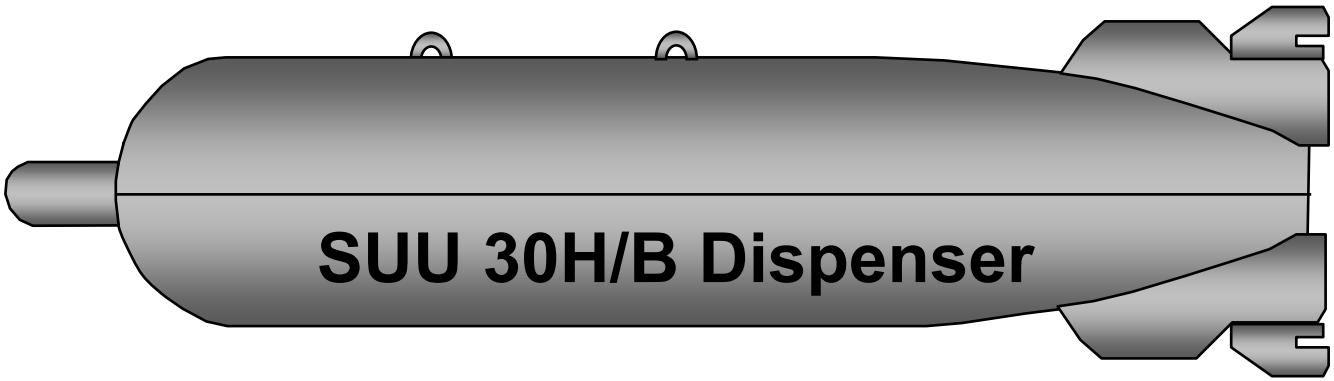
- Design is driven by performance, cost, and schedule
  - Demil adds additional constraints to each
- Actual Demil does not occur for 10+ years after development and production
- Design for Demil requirement must be measureable and verifiable

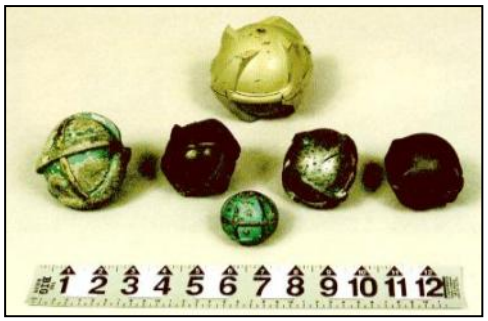
Requirements for Design for Demil

- Demil design requirements shall be defined in acquisition documentation
- Demil design requirements shall be included in the systems engineering process and documented in the Systems Engineering Plan
- Design for Demil activities and status shall be addressed in all program reviews
  - IPT meetings
  - Preliminary and Critical Design Reviews
  - Milestone entrance / exit reviews
- Valid and realistic demil cost estimates
- Demil Plan developed prior to milestone C
- Demil testing conducted during Developmental Testing

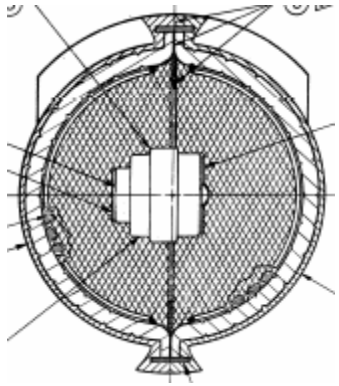
POOR DESIGN ⟶ INTRICATE DEMIL

Cluster Bomb Demil Facility at EBV EEC

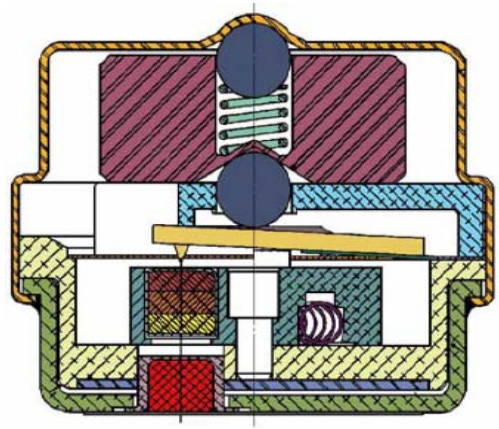




CBU Bomblets



Bomblet Cutaway View



Spin Arm Fuze

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Cluster Bomb Facility Requirements

- Combination of Automated and Manual Operations
  - Maximum Safety / Minimum Risk
  - To Achieve Highest Process Efficiency
- High Volume Throughput
  - To Complete Contract Requirements
  - Enough Capacity to Deplete similar assets in Demil Inventory
- Low Maintenance Requirements
- Bomblet Disassembly Operations are Remote Controlled with Video Monitoring
- Thermal Treatment of Energetics
- Robust process for Asset Variation

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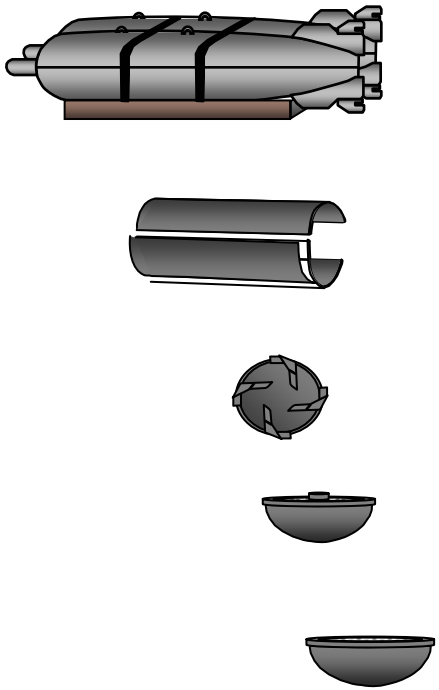
General Processes Cluster Bomb Family



Depalletize → Wood/Steel Packing and Strapping → Landfill or Mixed Metal Salvage

Opening of CBU Remove Bomblets → CBU Skin Empty Shell → Mixed Metal Salvage

Opening of Bomblets Remove Fuze → Fuze Thermal Treatment → Ash

Bomblet Hemispheres → Thermal Treatment Explosive → Metal Salvage

R^3

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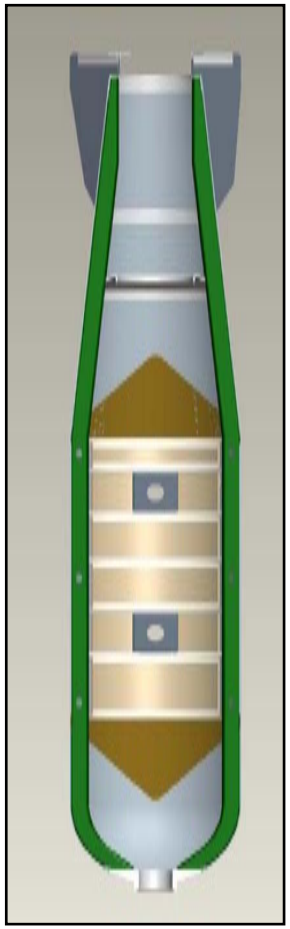
Production Methods - CBU Loading of Bomblets



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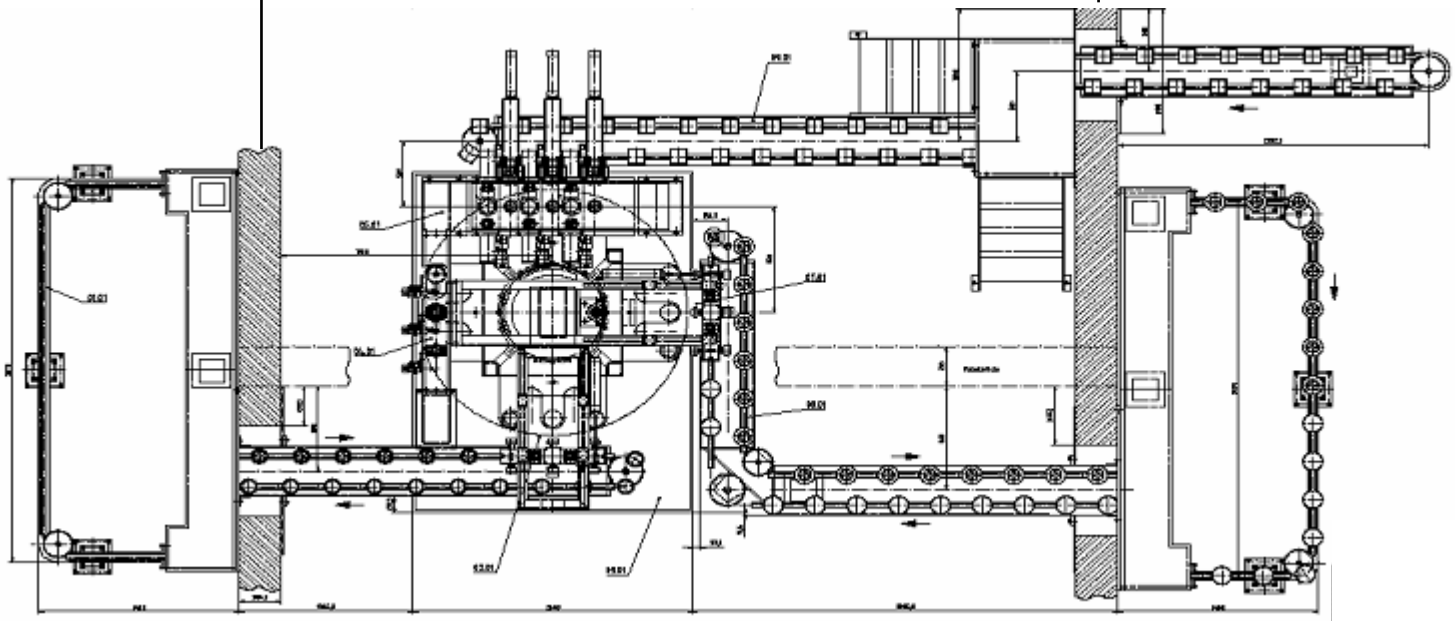
CBU Disassembly Line – Overall Layout

Input Bay | Safety Cell / Disassembly Bay | Output Bay



Top View

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CBU Demil Line – Processing Equipment

Disassembly Machine in Safety Cell

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Current CBU Demil Line Facilitization

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R^3

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Demil Center of Excellence for Cluster Ammunition

- GD-OTS has teamed with EBV EEC to Create the Leading Center of Excellence for Demil of Assets Containing Submunitions
- Engineered Solutions that are Safe, Robust, Efficient, and Low-Cost
- Proven Capabilities across Range of Demil Items
- Design and Implementation of CBU Line in 8 months
- Generation 4 ICM Line in Operation

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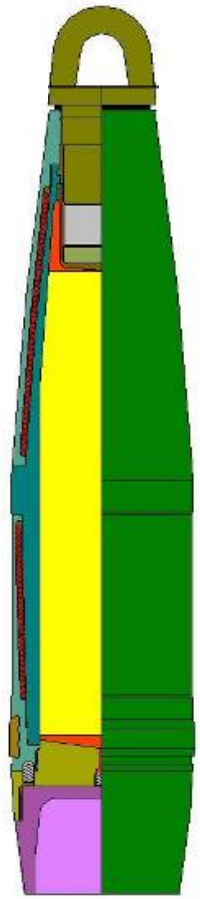
GOOD DESIGN ⟶
SIMPLE DEMIL

M1130 105mm PFF Background



- In 2002, the Advanced Cannon Artillery Ammunition Program (ACA2P) was created to help modernize conventional artillery ammo
- Need for high effectiveness against soft targets without the use of DPICM's
- Recently Type Classified
- IM requirements aided design being demil friendly

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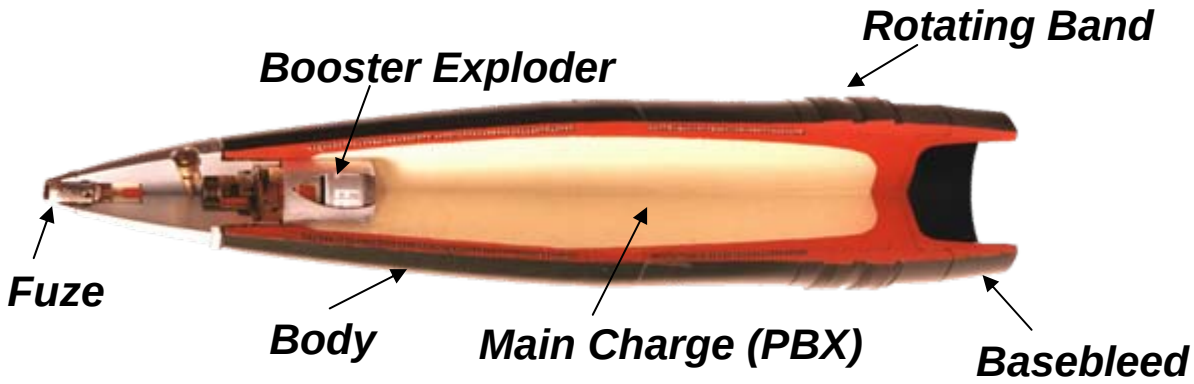
Demil Processes - M1130 105mm IM HE PFF



Main Demil Processes:

- **Basebleed – Unscrew and thermally treat**
- **HE Explosive Fill**
  - **Simple access by extracting pins and unscrew plug**
  - **Waterjet washout of HE and recycling**
- **Flash projectile body to react booster**
- **Thermally treat fuze**
- **>97% Resource Recovery and Recycle (R^3) Rate**

Simple and low cost Demil solution

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GD-OTS Design for Demil Summary

GD-OTS uniquely positioned for Design for Demil activities:

- **In-house ammunition development and production expertise**
- **In-house demilitarization expertise**
- **Entire life cycle management**

GD-OTS Design for Demil Services:

- **Design for Demil Requirements Analysis**
- **Demilitarization Systems Engineering**
- **Demilitarization Plan Development**
- **Demil Cost Estimations**
- **Design for Demil Activity Management**

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Copper Cone Recycling


Bombs to Wheels

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