Insensitive Munitions and Energetic Materials Technology Symposium

April 23-26, 2018 | Portland, OR

Life Cycle Demilitarization Considerations for IM Development

Abstract Number 20114

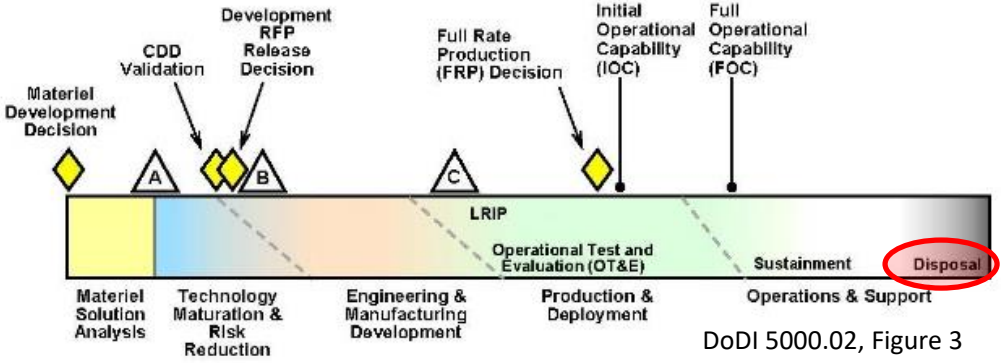
Agenda

- Demil in the Life Cycle
- Demil Stockpile
- Demil Mission
- Demil Capabilities
- IM Challenges in Demil
- IM Examples in Demil
- Design Recommendations
- Design for Demil

Demil in the Life Cycle

- **Requirement:** "At the end of its useful life, a system will be demilitarized and disposed of …"

  – DoDI 5000.02 5.d.(14)(b)2, 7 Jan 2015



DoDI 5000.02, Figure 3

Definitions

Demilitarization: "The act of *destroying the military offensive or defensive advantages … to prevent the further use* of this equipment and material for its originally intended military or lethal purpose …"

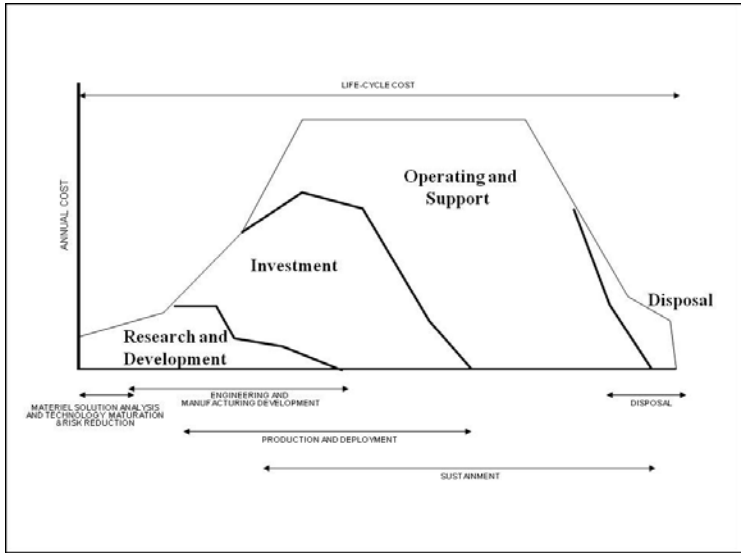
Disposal: The process of reutilizing, transferring, donating, selling, destroying, or other *ultimate disposition* of personal property.

- DoD 4160.21-M, Aug 1997 (Defense Materiel Disposition Manual)

- Ammunition is designated for demil by each Service when it becomes obsolete, unserviceable, or excess or is unsafe for storage.

Demil Significance

- Life cycle cost.



Operating and Support Cost-Estimating Guide, March 2014

- Facilitates storage & outload efficiencies (demil stocks co-mingled with go-to-war).

- Safety and environmental liability/implications.

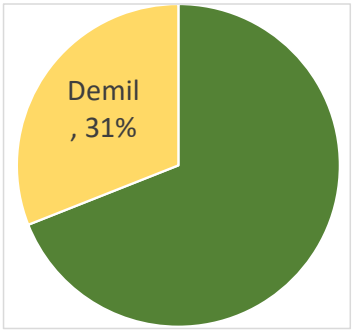
Need to ensure sustainability over the life cycle.

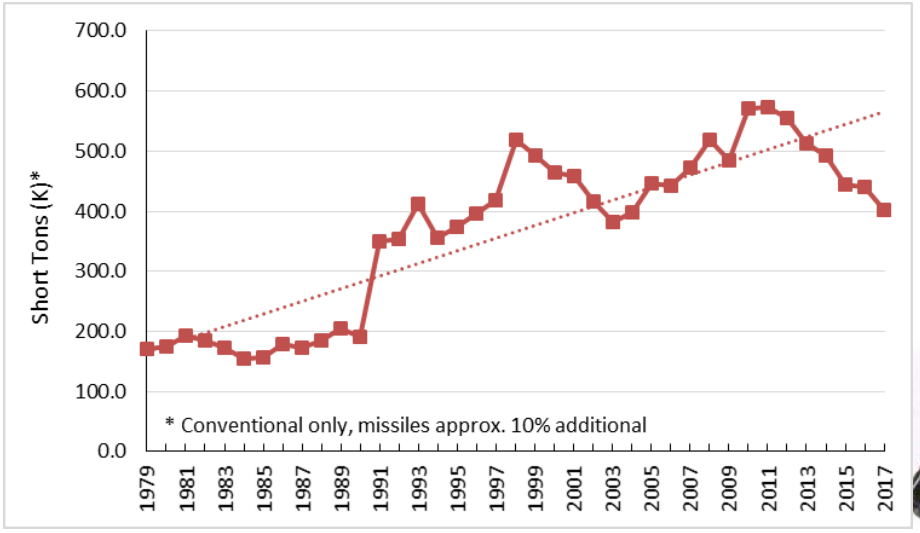
Demil Stockpile

- Large, diverse stockpile
  - ~414K short tons*
  - >7,000 DODICs
  - Continual generations into
  - >$1.15B liability

* as of EOM Feb 2018

- Demil stockpile occupies over 31% of covered storage space at depots.

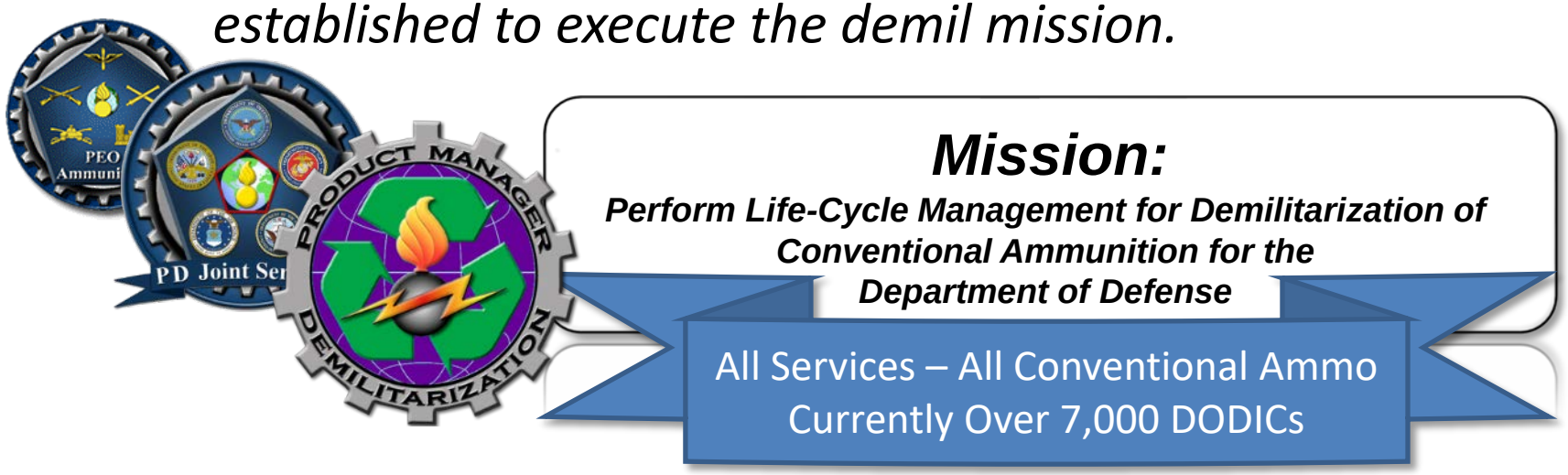




- Future ammo more complex.

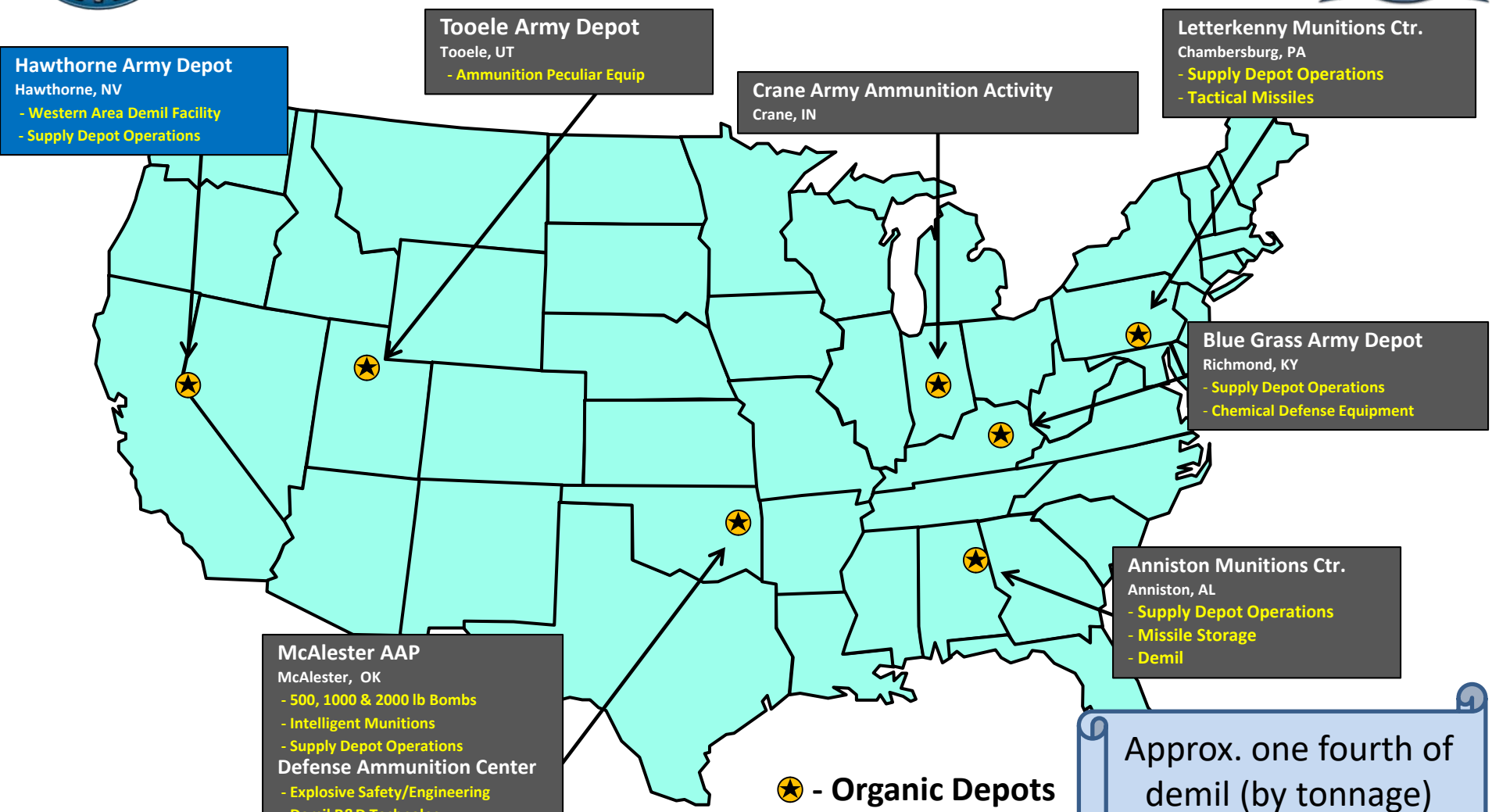
Demil Mission

- Single Manager for Conventional Ammunition (SMCA)
  - *Established to gain efficiencies in the procurement, production, and **demilitarization** of **conventional ammunition** for **all Military Services** (DODD 5160.65)*
- *PEO Ammo delegated as SMCA Executor in 2002; PD Demil established to execute the demil mission.*



- Supported by the Demilitarization Enterprise.
  - Joint Munitions Command
  - Aviation and Missile Command
  - Armament RDT&E Center
  - Aviation and Missile RDT&E Center

Organic Demil Sites



Approx. one fourth of demil (by tonnage) done commercially.

Demil Capabilities

Closed Disposal

FY13 R3 value $8.16M

Disassembly

Explosives Removal

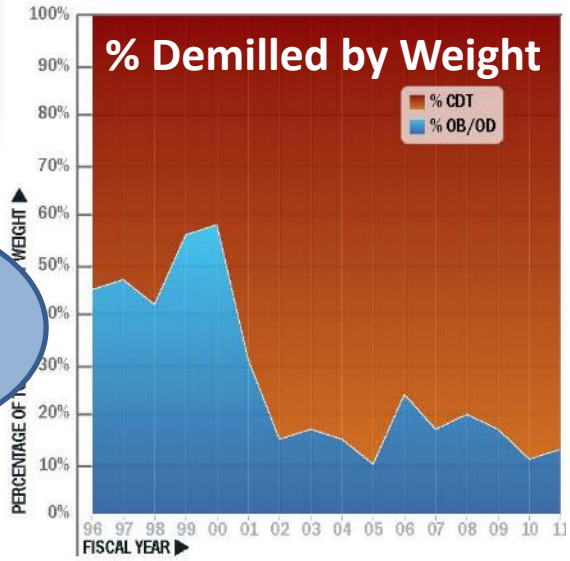
Thermal Treatment

New Capabilities Under Development

Open Burn / Open Detonate

100% Done at Organic Sites

60-100K stons per year



Demil Capabilities

- Demil capabilities tailored to munition type and fill, can be complex and costly.







UNCLASSIFIED

Demil of Larger Energetic Fills

- Energetics are the biggest challenge to demil.
- For larger items (mortars, 105/155MM, bombs), energetics typically removed.
  - Autoclave (melt out by application of heat)
  - Water wash out (high pressure, hot water, etc.)
  - Sectioning
- Energetics reused where possible (new production, donor material for open detonation).

IM Challenges

- Traditional method of demil (melt out and recovery) not possible with cast-cured energetics.
- Technologies are available for cast-cure, but ...
  - Energetics can't be reused, resulting in lost value & increased demil cost.
  - OD not possible, more costly demil.
  - Will require extensive facility modifications (i.e. $$$) to implement removal and destruction capabilities.
  - Environmental, health and safety challenges (e.g. AP, DNAN) requires modifications to water treatment facilities, personnel protection.

105MM/155MM Example

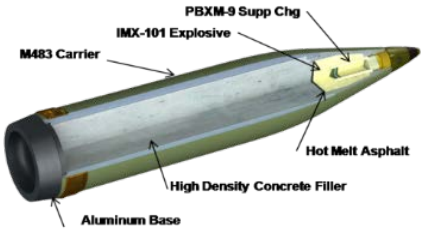
Existing Demil Process
Autoclave Melt-Out

- Melt pour explosives remelted and removed through steam heating
- Explosives recovered for reuse in new production or as a donor for open detonation

IM Issues

- M795 IMX 101 is melt pour but different melt dynamics. Requires modification to autoclaves, capital investment at depots.

- XM1122 tar lining difficult to process.



- New facilities needed for explosives destruction.

BLU-109C/B (AFX-757) Example

- Air Force 2,000 lb penetrator warhead.
- Production rejects demilitarized to recover metal body for reuse.
  - Explosive slug removed through applied heat.
  - Open burning of the removed explosive.
- No demil facilities exist.

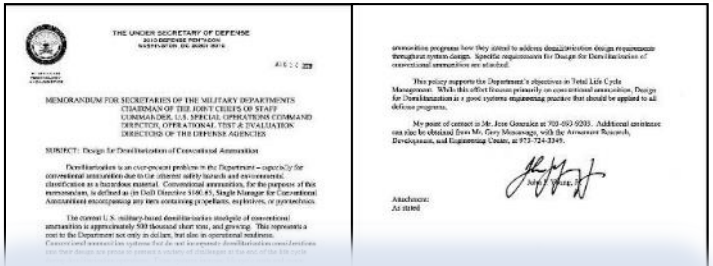
Design Considerations

- General design considerations.
  - Ease of disassembly.
  - Facilitate removal/segregation of energetic fills.
  - Potential for reuse of energetics, separation from binders.
  - Minimize environmentally impacting ingredients.
- Innovative approaches.
  - Example: Early research being considered in "depolymerizable thermosets." Cast-curable polymer that can be "liquitized" on demand for removal.

Design for Demil (DFD)

- Early consideration of demil as a life cycle requirement, i.e. good systems engineering.

DFD policy by USD(AT&L)



THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
COMMANDER, U.S. SPECIAL OPERATIONS COMMAND
DIRECTOR, OPERATIONAL TEST & EVALUATION
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Design for Demilitarization of Conventional Ammunition

Demilitarization is an ever-present problem in the Department – especially for conventional ammunition due to the inherent safety hazards and environmental classification as a hazardous material. Conventional ammunition, for the purposes of this memorandum, is defined as in DoD Directive 5160.65, Single Manager for Conventional Ammunition encompassing any item containing propellants, explosives, or pyrotechnics.

The current U.S. military-based demilitarization stockpile of conventional ammunition is approximately 500 thousand short tons, and growing. This represents a cost to the Department not only in dollars, but also in operational readiness.

Conventional ammunition systems that do not incorporate demilitarization considerations into their design can pose or contribute a variety of challenges at the end of the life cycle.

ammunition programs how they intend to address demilitarization design requirements throughout system design. Specific requirements for Design for Demilitarization of conventional ammunition are attached.

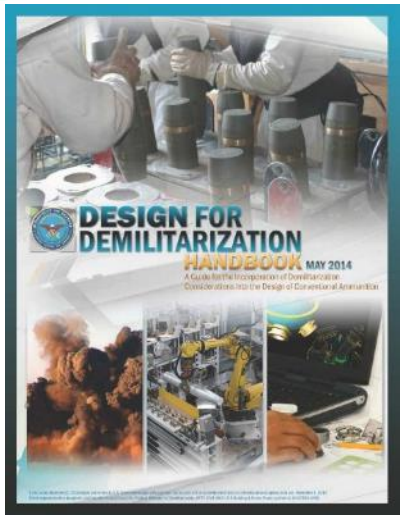
This policy supports the Department's objectives in Total Life Cycle Management. While this effort focuses primarily on conventional ammunition, Design for Demilitarization is a good systems engineering practice that should be applied to all defense programs.

My point of contact is Mr. Jose Gonzalez at 703-693-9203. Additional assistance can also be obtained from Mr. Gary Messenger, with the Armament Research, Development, and Engineering Center, at 973-724-3349.

Attachment:
As stated

"… include in … acquisition documentation … how (you) intend to address demilitarization design requirements throughout system design."

DFD Handbook



- Endorsed by OSD and the Joint Ordnance Commander's Group.
  - Roles & Responsibilities
  - DFD in the Acquisition Process
  - Design Considerations & Best Practices
  - Policy & Regulation
  - Demil Process Info
  - Lessons Learned

Not a design driver, but opportunities exist if properly considered.

Summary

- Demil is a life cycle function important to sustaining warfighter readiness and impacts safety, environmental, and cost.
- A proper systems engineering approach will ensure demil is properly considered during early development, resulting in positive life cycle impacts.