

**GENERAL DYNAMICS**

Ordnance and Tactical Systems

Munition Services

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**Improving Safety of Demil Operations  
Through Automation**

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## Report Documentation Page

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# Introduction

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- Demil True/False Test
- Discussion of Test Answers
- Challenges of Demil
- Impact of Demil Challenges on Operations
- Addressing Demil Challenges through Automation and Unattended Operations
- Summary
- Conclusion

# Demil True/False Test

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1. Demil is simply reverse assembly! T/F
2. Being successful in ammunition manufacturing ensures you can be successful in ammunition demil! T/F
3. Everything you need to know to demil a munition can be obtained from the TDP! T/F

# True/False Test Answers

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1. Demil is simply reverse assembly! T/F  
False – Munitions won't come apart like they were put together
  - Use of cement, crimping, staking, etc.
  - Explosive hazards present on all parts of disassembly during demil vs. present primarily on final assembly

# True/False Test Answers

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2. Being successful in ammunition manufacturing ensures you can be successful in ammunition demil! T/F

False – In general, ammunition manufacturers who have tried demil are no longer in demil business

- Knowing how you put munitions together doesn't necessarily translate to knowing how to take it apart – refer to Question 1. comments
- Also, assembly knowledge often not available at time of demil

# True/False Test Answers

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3. Everything you need to know to demil a munition can be obtained from the TDP! T/F  
False – TDPs, however carefully prepared, have missing details, undocumented changes, undocumented variation in materials, dimensions, quality defects, and other variations. Don't address changes due to aging, deterioration, impacts from various environmental exposures, etc.

# Challenges of Demil

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- Demil involves munitions that are:
  - Outdated/obsolete
  - Defective
  - Deteriorated
  - Not designed for demil
- Each of the above conditions present special problems



# Impact of Demil Challenges on Operations

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- Outdated/obsolete
  - Incomplete/missing TDP information
  - No inert items available for equipment prove-out – must use live items

Examples – M23 VX Land Mine – punching through burster cover plate to remove booster pellet

- TDP showed plastic burster cover plate
- Large number had metal burster cover plate



# Impact of Demil Challenges on Operations

## Examples – Cluster Bomb Disassembly

- No inert cluster bombs for use to develop and test bomblet disassembly equipment – used live bomblets
- Bomblets loaded in water in dispenser – some rusted – Voids filled with wood blocks & foam



# Impact of Demil Challenges on Operations

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- Defective

- May be more sensitive to handling operations

Example – Fuzed 105mm projectiles had fuzes spun on at rotation speed that armed the fuzes

- ❑ Required totally remote disassembly operations

- ✓ Box opening

- ✓ Removal of complete rounds from fiber tubes

- ✓ Removal of fuze

# Impact of Demil Challenges on Operations

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- Deteriorated
  - Present unique and unknown conditions, e.g., explosives in threads, more sensitive compounds, poor structural integrity

Extreme examples –

- ✓ Corroded 20mm cartridges – required emergency demil by OD
- ✓ Explosive D projectiles with explosives in fuze threads – caused explosion during defuzing operation

# Impact of Demil Challenges on Operations

Corroded  
20mm HE  
Cartridges

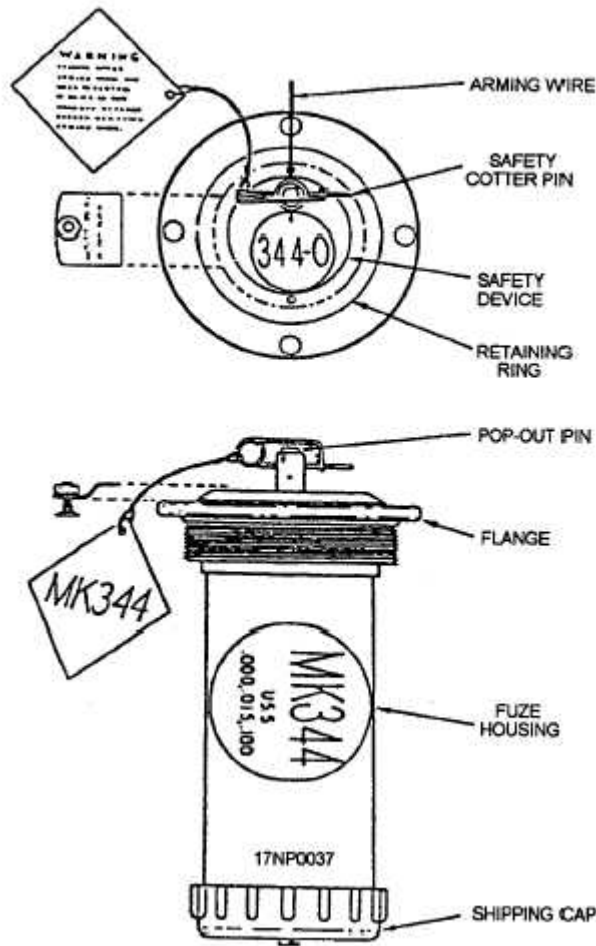


# Impact of Demil Challenges on Operations

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- Not designed for demil
  - Use of cement, staking, crimping makes disassembly more difficult
  - Detents/flats OK for assembly may be insufficient for disassembly
  - Insufficient protection to keep PEP out of threads
  - No access to fuze - Inability to determine if item is in safe condition

# Impact of Demil Challenges on Operations



## Example – MK 344 Bomb Fuze

- **Booster closure screwed into housing and staked**
- **Drilling out stakes still wouldn't allow disassembly by unscrewing – detent holes too small – tooling broke – cap also broke**



# Impact of Demil Challenges on Operations

MK344  
Bomb Fuze  
– Difficult to  
remove  
booster  
closure



# Impact of Demil Challenges on Operations

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## Example – MLRS Warhead

- **Fuze threads glued and staked – required cutting fuze housing off warhead**
- **Foam grenade supports for M77 grenades glued into warhead casing**

# Impact of Demil Challenges on Operations

## Example – CBU Bomblets

- Bomblet halves crimped



# Impact of Demil Challenges on Operations

## Example – CBU Bomblets

- Fuze glued into bomblet



# Impact of Demil Challenges on Operations

## Example – M483 155mm ICM Projectile

- Safety pins removed from grenade fuzes during final assembly



# Addressing Demil Challenges thru Automation/Unattended Operations

- Automated/unattended operations are critical when operation being performed:
  - Could cause initiation of a munition
  - Requires large application of force for disassembly
  - Involves cutting/shearing/sawing
  - Involves suspect conditions e.g., explosives in threads, sensitive components, potentially armed conditions, etc.

# Addressing Demil Challenges thru Automation/Unattended Operations

- Automated operations can be justified when:
  - Quantity of munitions to be demiled makes development of automated equipment cost effective and efficient
  - Involves multiple process steps where initiation is possible
  - Risks to personnel from operations is high
- Operations are conducted unattended in Safety Cells – bays enclosed by concrete or steel walls

# Addressing Demil Challenges thru Automation/Unattended Operations

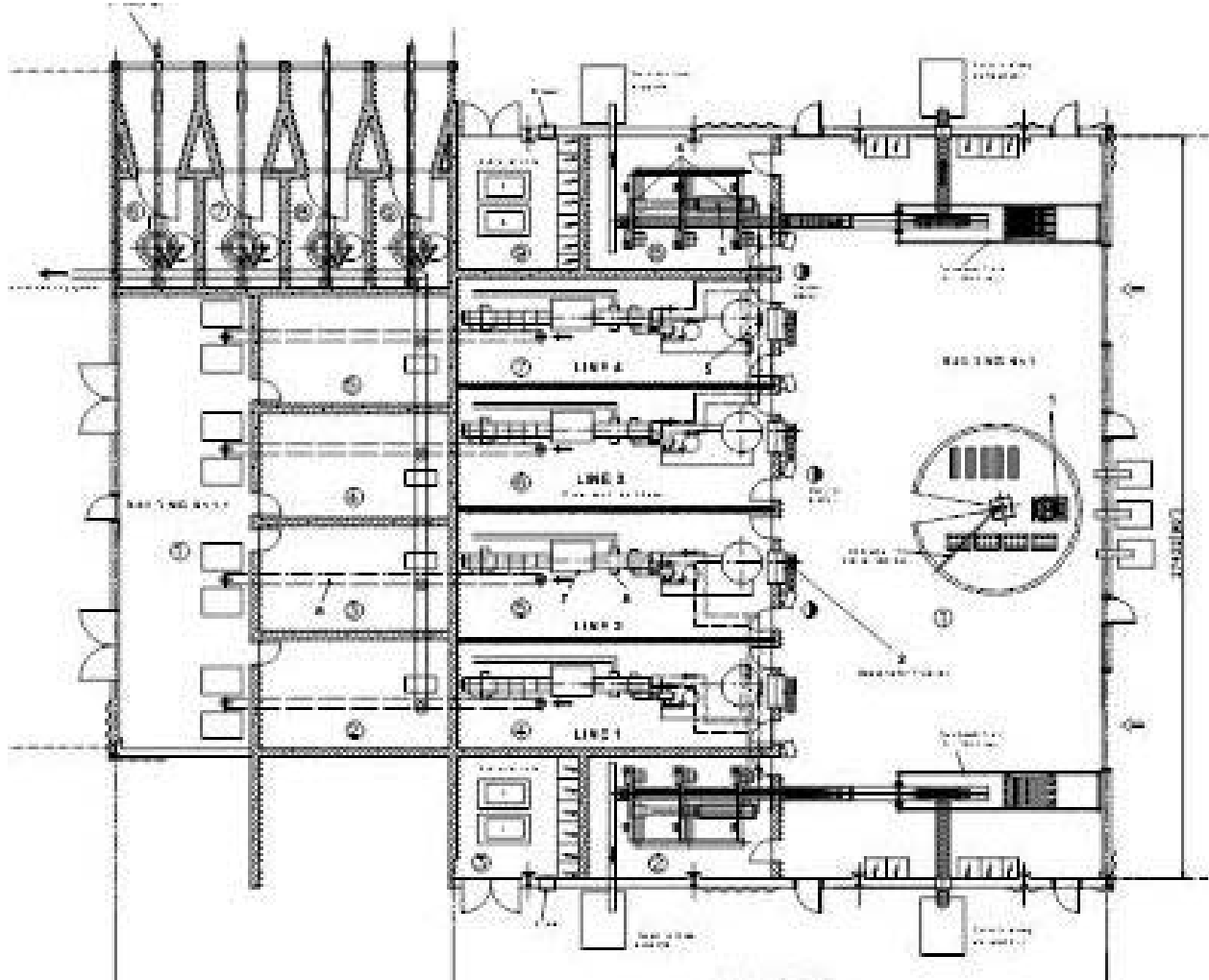
- Examples of efficient, cost effective automated demil operations at GDOTS Munition Services
  - MLRS automated demil operations
    - Warhead download – removal of 644 M77 grenades
    - M77 Grenade disassembly
      - Arming ribbon removal
      - Removal of fuze
      - Removal of copper cone
      - Thermal treatment of grenade explosives
    - Rocket Motor sawing and thermal treatment



# Addressing Demil Challenges thru Automation/Unattended Operations

- M483 155mm ICM projectile automated demil operations
  - Projectile download – removal of 88 M42/M46 grenades
  - M42/M46 Grenade disassembly
    - Arming ribbon removal
    - Removal of fuze
    - Removal of copper cone
    - Thermal treatment of grenade explosives

# Addressing Demil Challenges thru Automation/Unattended Operations

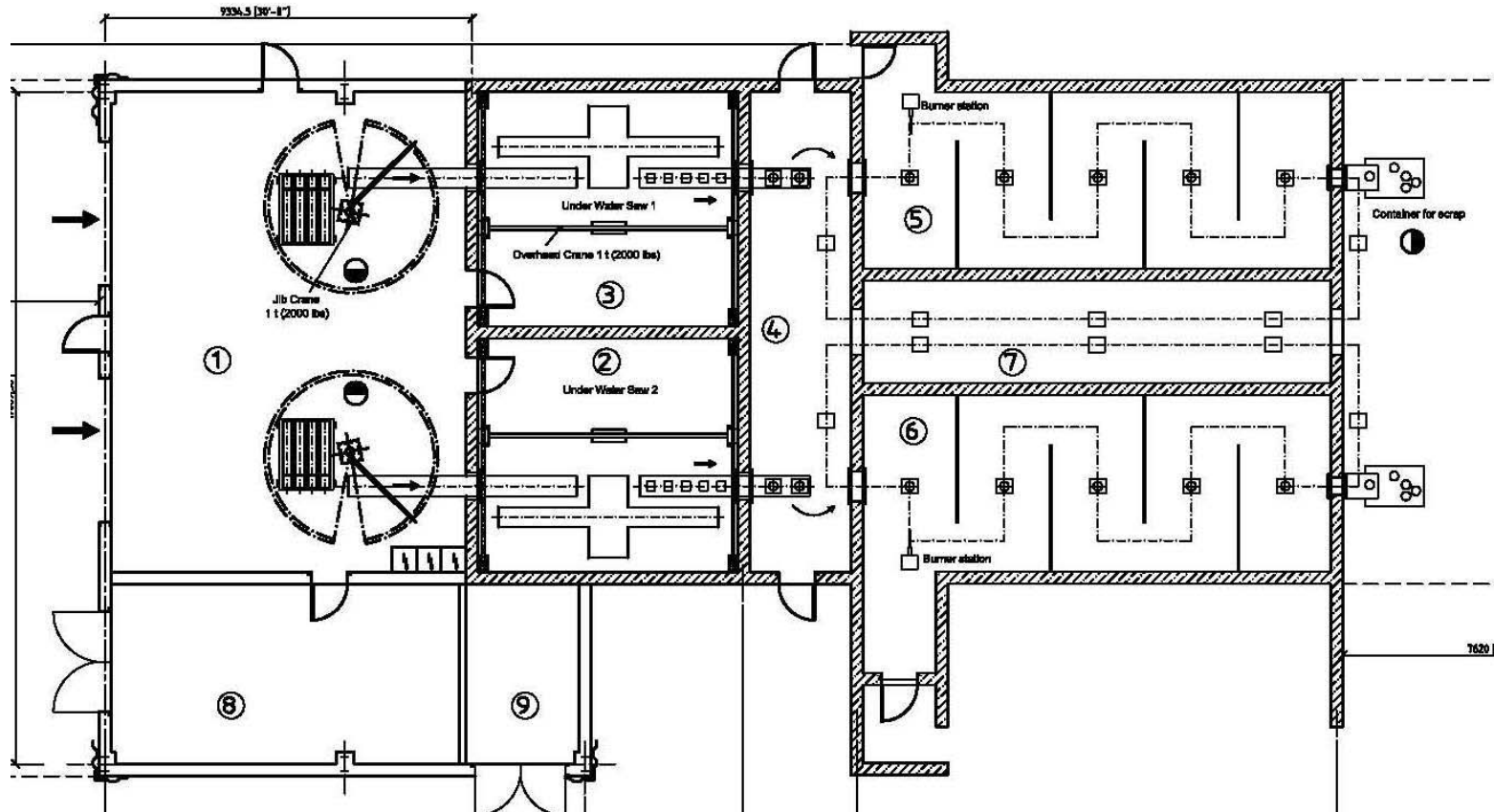


**MLRS/ICM  
Disassembly  
Building**

# Addressing Demil Challenges thru Automation/Unattended Operations

- M26 MLRS Rocket Motor Cutting and Thermal Treatment
  - Rocket motor cutting – underwater saws
    - ✓ Conducted unattended in containment cell
  - Rocket motor segment thermal treatment
    - Segments burned unattended in thermal treatment units
    - Acid exhaust gases neutralized in APCS
    - Particulate removed from exhaust gases in APCS

# Addressing Demil Challenges thru Automation/Unattended Operations



## Rocket Motor Cutting and Thermal Treatment Building

# Addressing Demil Challenges thru Automation/Unattended Operations

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- Unattended operations are used when:
  - Quantity of munitions to be demiled is small – doesn't warrant development of automated equipment
  - Still involves process steps where initiation is possible
  - Risks to personnel from operations is high
- Operations are conducted unattended in Safety Cells – bays enclosed by concrete or steel walls

# Addressing Demil Challenges thru Automation/Unattended Operations

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- Examples of unattended operations at GDOTS Munition Services
  - Disassembly of pyrotechnic munitions
    - 4.2” illuminating mortar disassembly
    - Photoflash cartridge cutting

# Addressing Demil Challenges thru Automation/Unattended Operations



# Summary

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- Demil operations are difficult with many more challenges and hazards than are present with munitions assembly operations
- Demil requires the application of sound engineering principles for equipment design
- Demil requires hazardous operations to be conducted unattended in safety cells
- Automation of demil operations is justifiable with large numbers of like munitions
- Unattended operations used w/small quantities



# Conclusion

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- Demil operations can be accomplished safely through the use of properly designed automated equipment in safety cells, or the use of unattended disassembly equipment in safety cells
- Understanding all of the potential hazards and consequences associated with demil enables the proper design of demil operations and equipment

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# **GENERAL DYNAMICS**

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