

# Use of Energetic Materials Outside U.S. DOD

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- **Presentation Objective**
- **Requirements for non-DOD Applications**
- **Review of non-DOD Energetic Material Users**
- **Summarize Need for Continued DOD Support**
- **Questions, Comments, and Potential Edits**

# Objective of Presentation



## I Want feed back

- This will be published
- Want accuracy
- SME Community
- If incorrect
- Please let me know



# Chapter Summary



- **Chapter Goals**

- Understand where energetic materials are used and their impact
- Determine if additional EM advancements will continue without DOD support

**The U.S. DOD controls current energetic material advancements**

**Book objective – describe contribution of EM to strength of DOD**

**Why devote an entire chapter to EM use outside the DOD?**

**Industries and products have resulted as a side benefit**

- From DOD EM support
- Significantly affected Americans
- Without past/future DOD EM support – lives significantly altered

- **Chapter Organization (~20 pages)**

- Introduction
- Required Effort to Develop Energetic Material Technologies
- Evaluation of non-DOD requirements and relation to DOD requirements
- Assessment of each non-DOD organization/industry
- Effectiveness of DOD funding on current and future non-DOD industries

# Required Effort to Develop Energetic Material Technologies

## Low Probability of Success

- Successes are rare
- GAP and CL-20

## High Costs

- Facilities/Operations/procedures
- Government Regs
- Expertise
- Infrastructure
- Shipping

## Proprietary Rights

- Difficult to maintain when competing for government funds
- Term for success may exceed protection

## Long-Term Commitment

- > 10 years for success

**Low Payoff**

# Advanced EM Requirements for non-DOD Use



**DOD EM requirements** ↔ **non-DOD use requirements**

## Safety

- Safe energetic material not an oxymoron
- Key concern when EM handled by non-trained personnel
- Industry experience key to non-DOD: knowledge, regulations, lessons learned

## Reliability

- Extreme importance
- SOTA not acceptable – Yesterday's SOTA is desired

## Green

- Cradle to grave considerations
- Industry Life Cycle environment considerations are applicable

## Performance

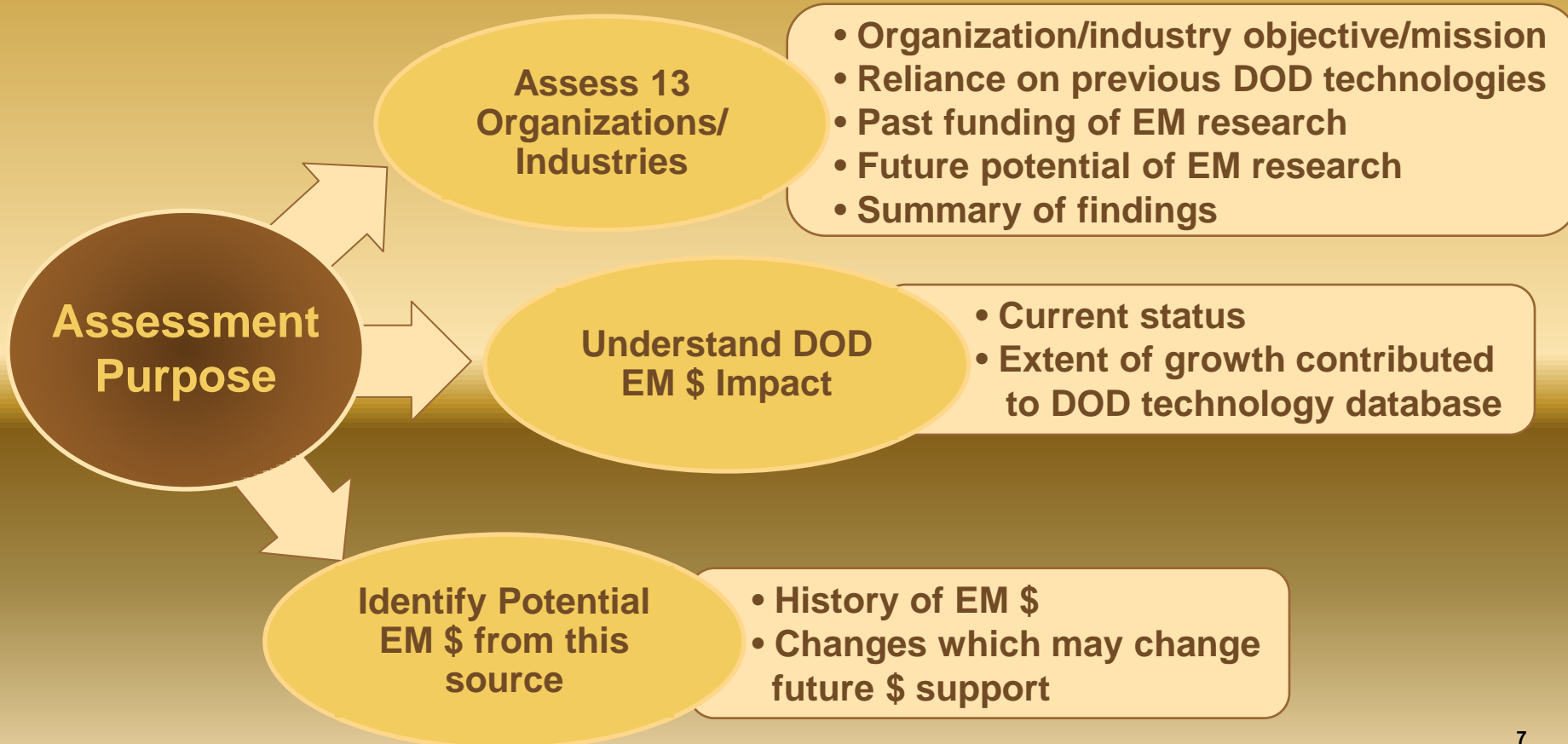
- Not impulse or blast/fragmentation
  - Desire is smoke, gas, etc.
- Output of our industry evaluation is often suitable

## Cost

- Like our industry – key: Never used if too expensive

# Assessment of Non-DOD Uses of EM

- EM use continues to expand beyond DOD
  - Evidence of commonality in our daily lives
  - Mostly – grown from DOD EM technology database
  - Little or no funding to date outside DOD



# Assessment of Non-DOD Uses of EM

## Other U.S. Government Agencies



Org	Product/Mission	Reliance on Past DOD Technologies	Funding Source?	
			Past	Future Potential
DOE	Nuclear material policy responsibility <ul style="list-style-type: none"> <li>• Explosives to initiate or replace nuclear materials</li> <li>• HEAF primary responsibility for non-nuclear EM</li> </ul>	<ul style="list-style-type: none"> <li>• Largest EM funding outside DOD</li> <li>• Does not rely on DOD successes</li> </ul>	Yes <sup>1</sup>	Yes <sup>1</sup>
NASA	Nation's civilian space program & aeronautics/aerospace research <ul style="list-style-type: none"> <li>• DOD in IHP RPT and RP-21</li> <li>• EM funds directed towards reliability</li> <li>• No one Org controls EM funds</li> </ul>	Yes – for initial launches Takes advantage of past SOTA	Yes <sup>2</sup>	Yes <sup>2</sup>
DHS	Protecting the U.S. and protectorates from terrorist attacks	<ul style="list-style-type: none"> <li>• EM Detection/test (airport security)</li> <li>• Understanding EM to offset terrorist capabilities</li> <li>• Blast protection</li> </ul>	No	No

<sup>1</sup> Most DOE funding of EM is for explosives, minimal for propulsion

<sup>2</sup> Most NASA funding is for reliability and safety, not performance increase

# Assessment of Non-DOD Uses of EM

## Private Related Industries



Org	Product/Mission	Reliance on Past DOD Technologies	Funding Source?	
			Past	Future Potential
Aerospace Contractors	<ul style="list-style-type: none"> <li>• Provide products containing EM under government contract</li> <li>• Desire latest SOTA and pushing technology</li> </ul>	<ul style="list-style-type: none"> <li>• Highly reliant on DOD funding</li> <li>• Internal funding for EM ingredients is limited</li> </ul>	Yes <sup>1</sup>	Yes <sup>1</sup>
Commercial Space Access	<ul style="list-style-type: none"> <li>• Low-cost access to space</li> <li>• Safe, reliable old technology</li> </ul>	DOD technology was basis for propellants	No	No
Gas Generators	Gas generator products for exhaust to perform specific function (e.g., Airbags, Fire ext. Replenishable batteries)	<ul style="list-style-type: none"> <li>• DOD technology was basis for starting EMs</li> <li>• Significant previous funding by airbag industry</li> </ul>	Yes	No
Specialty Tools	Gas generator products which propagate blast wave	DOD technology was basis for starting EMs	No	No

<sup>1</sup> Private industry EM typically for formulation development not new ingredients  
 -No payoff for new ingredient work: lack of patent protection and long-term pay out

# Assessment of Non-DOD Uses of EM Niche Markets



Org	Product/Mission	Reliance on Past DOD Technologies	Funding Source?	
			Past	Future Potential
Fireworks/Special Effects	Provide explosions, smoke, loud noises, fireworks, etc. in presence of personnel	<ul style="list-style-type: none"> <li>• Industry established before DOD existed</li> <li>• Primary dependence on 100+ yr-old technology</li> </ul>	No	No
Explosives	Deliver precise blast capability for destruction and removal	<ul style="list-style-type: none"> <li>• Industry established before DOD existed</li> <li>• Primary dependence on 100+ yr-old technology</li> </ul>	No <sup>1</sup>	No <sup>1</sup>
Model Rockets	Propellant grains for the back-yard rocketeer	DOD technology was basis for starting EMs	No	No
Hunting Supplies	i.e., bullets – only included for completeness	DOD technology was basis for starting EMs	No	No

<sup>1</sup> Occasionally the commercial explosives industry required/s developing specialized products

# Assessment of Non-DOD Uses of EM Niche Markets (Con't.)



Org	Product/Mission	Reliance on Past DOD Technologies	Funding Source?	
			Past	Future Potential
Pharmaceutical	Provide pharmaceutical products for health care	None	Yes <sup>1</sup>	Yes <sup>1</sup>
Other	Application of related EM technologies <ul style="list-style-type: none"> <li>• Computer models</li> <li>• Analysis techniques</li> </ul>	EM technology development required development of these technologies	No	No

<sup>1</sup> Pharmaceutical industry funds development of new chemicals which coincidentally are EMs

# Summary and Conclusions

- **Chapter 7 goals**
  - Understand where, outside DOD, EMs are used in US & impact of their use
  - Determine if EM advancements will continue without DOD support
- **Non-DOD/DOD EM requirements are same with different priorities**
- **13 organizations/industries were assessed**
  - **Reliance on past DOD funds**
    - Most directly resulted from past DOD support of EM
    - Commercial explosives and special effects/fireworks started prior to DOD\
  - **Potential as source for future EM funding**
    - Minimal future EM Support predicted by non-DOD
    - Only support for new ingredients – pharmaceutical and DOE
- **Bottom Line**
  - Evolution of EM use into daily lives occurred primarily because of DOD EM \$
  - Without continued DOD EM \$ no significant EM advancements expected
  - EM advancements provide opportunities for snow-balling effect
    - Additional growth and new industries
  - Government (DOD & DOE) only real source of U.S. energetic material \$

# Feedback and Comments



**HELP WANTED**  
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