

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

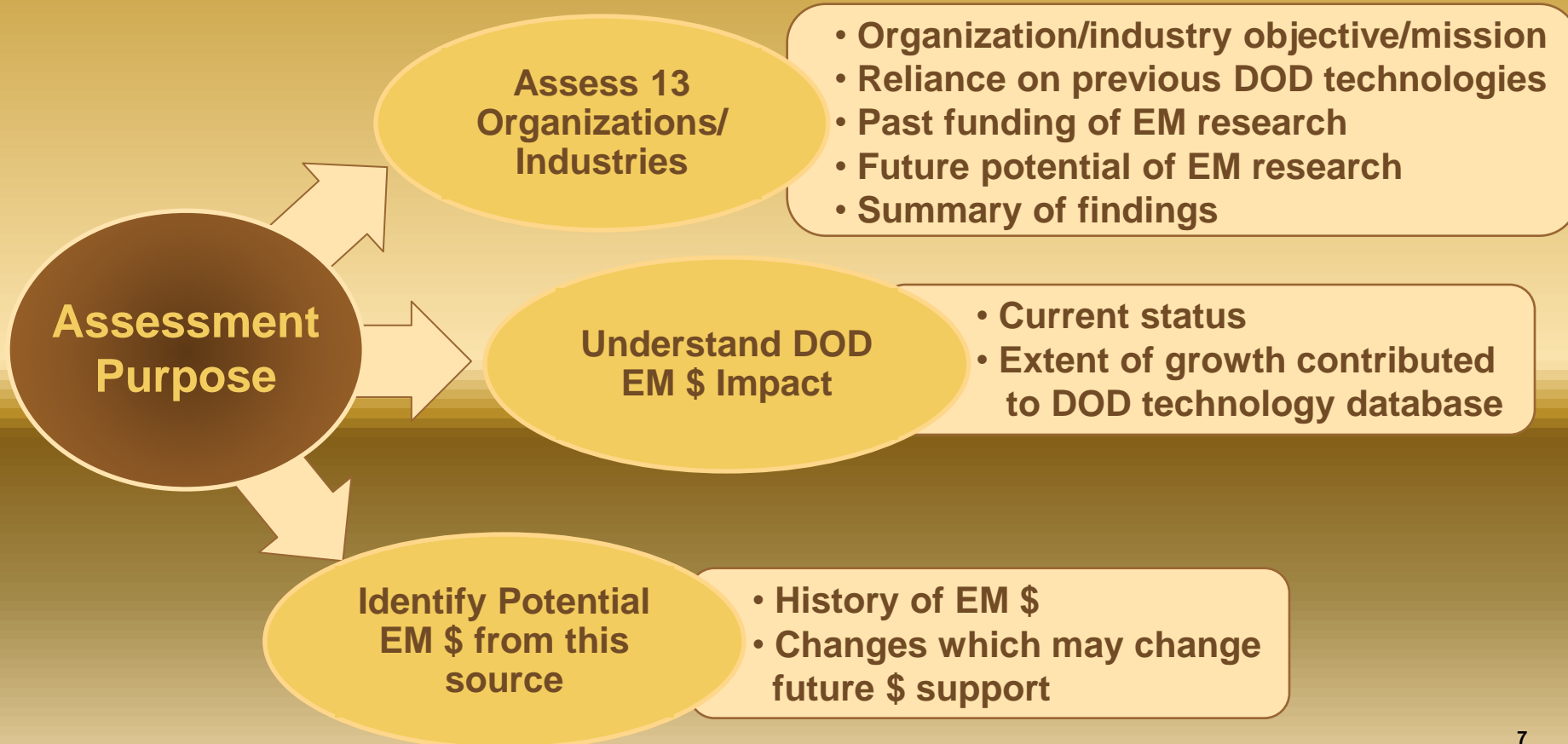
- Not impulse or blast/fragmentation
 - Desire is smoke, gas, etc.
- Output of our industry evaluation is often suitable

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

¹ Most DOE funding of EM is for explosives, minimal for propulsion

² 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"> • Provide products containing EM under government contract • Desire latest SOTA and pushing technology 	<ul style="list-style-type: none"> • Highly reliant on DOD funding • Internal funding for EM ingredients is limited 	Yes ¹	Yes ¹
Commercial Space Access	<ul style="list-style-type: none"> • Low-cost access to space • Safe, reliable old technology 	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"> • DOD technology was basis for starting EMs • Significant previous funding by airbag industry 	Yes	No
Specialty Tools	Gas generator products which propagate blast wave	DOD technology was basis for starting EMs	No	No

¹ 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"> • Industry established before DOD existed • Primary dependence on 100+ yr-old technology 	No	No
Explosives	Deliver precise blast capability for destruction and removal	<ul style="list-style-type: none"> • Industry established before DOD existed • Primary dependence on 100+ yr-old technology 	No ¹	No ¹
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

¹ 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 ¹	Yes ¹
Other	Application of related EM technologies <ul style="list-style-type: none"> • Computer models • Analysis techniques 	EM technology development required development of these technologies	No	No

¹ 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

