



# FY2020 NDAA Section 253 and FY2021 NDAA Section 273 Energetics Plan

Office of the Under Secretary of  
Defense Research and  
Engineering

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# The Requirement

## **FY20 NDAA Section 253 and FY21 NDAA Section 273**

(a) **PLAN REQUIRED**—The Under Secretary of Defense for Research and Engineering shall, in coordination with the technical directors at defense laboratories and such other officials as the Under Secretary considers appropriate, develop an energetics research and development plan to ensure a long-term multi-domain research, development, prototyping, and experimentation effort that—

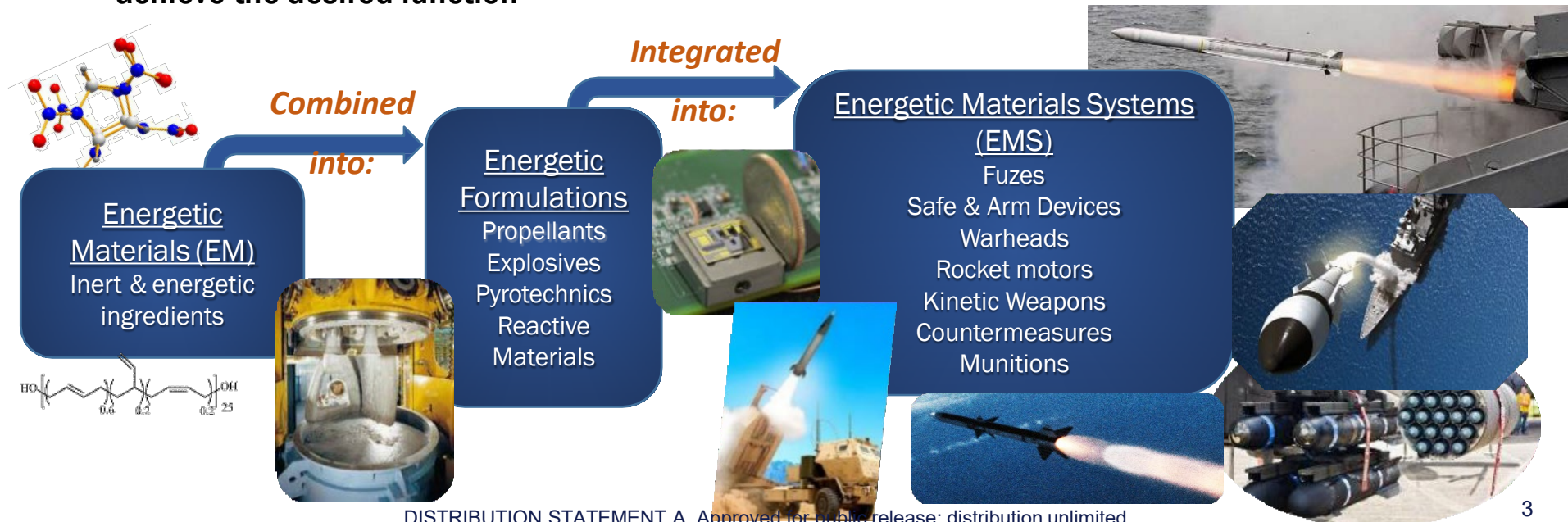
- (1) maintains United States technological superiority in energetics technology critical to national security;**
- (2) efficiently develops new energetics technologies and transitions them into operational use, as appropriate;**
- (3) maintains a robust industrial base and workforce to support Department of Defense requirements for energetic materials; and**
- (4) assesses the feasibility and advisability of establishing a program office—**
  - (A) to coordinate energetics research; and**
  - (B) to ensure a robust and sustained energetics material enterprise.**

(b) **BRIEFING**—Not later than one year after the date of the enactment of this Act, the Under Secretary shall brief the congressional defense committees on the plan developed under subsection (a).



# Energetics

- A weapon system's performance is enabled by its energetics
  - Range, Speed, Lethality, Safety, Signature, Size/Weight, Logistics
- Energetics are:
  - **Ingredients:** monopropellants, fuels, oxidizers, polymer binders, plasticizers, curing agents, organic bonding agents, molecular stabilizers, and other specialized ingredients used in explosives, pyrotechnics, and solid propellants
  - **Formulations:** Complex combinations of these ingredients custom mixed for particular applications
  - **Energetics Systems:** Systems based on energetic-material effects (energy-release phenomena) to achieve the desired function





# Energetics Problems

- **Adversary anti-access and area denial (A2/AD) capabilities present challenges for current systems**
  - Range limitations create unacceptable platform risk
  - Even with newly developed technologies U.S. platforms face challenges within enemy targeting zones
- **Limited manufacturing capacity to meet current and future requirements**
  - Manufacturing facilities, even with modernization upgrades, still need repair and updating
  - Continual industry consolidation has resulted in single points of failure for numerous critical materials
  - No capacity for new energetic materials manufacturing
- **Multiple factors inhibit weapon system energetics innovation**
  - Inherently hazardous, energetic systems, require extensive safety and qualification of new technology
  - Program offices adopt risk-averse approach of using known and qualified existing materials
- **No clear method exists to address section 253 requirement without understanding critical problems with existing capabilities, infrastructure, and industrial base, and then developing solutions for the entire ecosystem**



# Study Structured to Meet Requirement

## Technology Development

“maintains United States technological superiority in energetics technology critical to national security”

**WG1**

**Energetics  
S&T**

**WG2**

**R&D Planning**

## Transition

“efficiently develops new energetics technologies and transitions them into operational use, as appropriate”

**WG3**

**Barrier to  
Energetics  
Implementation**

**WG4**

**Business &  
Investment  
Model**

## Acquisition & Sustainment

“maintains a robust industrial base and workforce to support Department of Defense requirements for energetic materials”

**WG5**

**Acquisition  
Planning**

**WG6**

**T&E  
Planning**

**WG7**

**Manufacturing &  
Supply**

This Energetics Plan represents the collective product of these senior executive-led working groups, conducted over a six-month period, by more than 90 people representing the Services, Missile Defense Agency (MDA), Department of Energy (DOE) - National Nuclear Security Administration (NNSA), and National Aeronautics and Space Administration (NASA).



# Challenges Identified

**LACK  
OF  
EM/EMS  
COORDINATION  
AND  
ENERGETICS  
STRATEGY  
ACROSS  
DoD**

- Lack of comprehensive understanding of EM capabilities, needs, and capacities across the enterprise
- Inability to quickly incorporate emerging technologies to EM/EMS
- Erosion of skilled workforce (college-educated and technician)
- Lack of qualification and prototyping resources to mature EMS
- Misaligned EMS Science and Technology (S&T) and Acquisition timelines
- Lack of coordinated Modeling and Simulation (M&S) capabilities enabling prediction, analysis of alternatives, and design
- Antiquated Test and Evaluation (T&E) methods and infrastructure
- Policies, regulations and requirements governing EM/EMS that increase acquisitions costs and extend transition timelines
- Lack of a centralized industrial master plan for energetics manufacturing capability
- Significant supply chain issues – fragile markets, foreign sources, single/sole sources
- Sporadic and weak demand signal leading to obsolescence and single-source failures
- Lack of commercial applications minimizes Industry R&D investments



# Energetics Plan Recommendations

**PROVIDES  
EM/EMS  
COORDINATION  
AND  
CENTRALIZED  
ENERGETICS  
STRATEGY  
ACROSS  
DoD**

**The Department should establish a strategic energetics responsible authority to:**

- provide oversight of,
- strategic direction for,
- and support development of,

**the DoD's energetics competency to bolster technology development, transition, and sustain the energetics enterprise.**

**The following functions would be executed by this authority or by groups coordinated and supported by this authority:**

- **Create and maintain an Energetic Systems Common Operating Picture (ES-COP)**
  - Prepare and maintain EM Roadmaps, aligned with Conventional Engagement Capability Roadmaps, for PMs to set EM project objectives, contract requirements, and milestones
  - Provide R&D and T&E project data to identify capability gaps for programs, align schedules, and establish insertion points





# Energetics Plan Recommendations

**PROVIDES  
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- **Establish public-private partnership(s) to facilitate exchange of information, enhanced collaboration, and shared resources**
  - Research Consortium conducting S&T and R&D in energetics and propellants
  - Manufacturing Cooperative to coordinate and mature emerging EM-EMS manufacturing methods
- **Develop production-quality user-friendly Modeling & Simulation (M&S) software framework for weapons' designers, Acquisition offices, T&E personnel, and operators to:**
  - Enable model-based systems engineering (MBSE) design based on system's performance
  - Allow Analysis of Alternatives (AoA) for PMs/PEOs and Acquisition Programs of Record
- **Modernize Test & Evaluation (T&E)**
  - Establish an "Energetics/EMS" portfolio element in the Test Resource Management Center
  - Utilize M&S for digital estimates of performance & safety, and to replace tests where possible
  - Use T&E facilities to execute independent Verification and Validation of M&S





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- Establish a BA4 program to mature, integrate, prototype, and demonstrate EM/EMS technologies, to reduce risk of integration into new weapon systems, and minimize qualification expenses to program offices
- Resource the OSD Critical Energetic Material Working Group to:
  - Assess critical EM-EMS supply chains as members' primary duties
  - Develop an energetics supply chain support tool of suppliers and manufactures
- Establish additional and sustain pilot-scale plants to mitigate current and future critical-material challenges and mature manufacturing technologies
  - Agile specialty chemical synthesis pilot scale plants
  - Refinery for raw materials to comply with necessary military standards
  - R&D plant to increase MRL and demonstrate new manufacturing technology
- Develop an EM manufacturing modernization plan for Service-owned manufacturing and processing facilities in coordination with the respective Services
- Create an EMS workforce development program for US citizens to work on EM and EMS within government RDT&E sites and the industrial base



# Energetics Plan Recommendations

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- **Work on establishing the following policy recommendations:**
  - **Ensure EMS under development and procurement shall incorporate energetic materials improvements, to the extent practicable, by adding to DoD 5000.1 Section 1.2 “z. Ensuring lethality, range and industry sustainment to provide credible deterrence and warfighting capability to the Joint Force, new munitions under development and procurement shall incorporate safe energetic materials and energetic material systems, to the extent practicable, that outperform, through lethality, range and/or other attributes, their previous generation. This evaluation of energetics capabilities shall occur throughout each acquisition phase, EM analysis of alternatives (AoA), technology maturation and risk reduction (TMRR), engineering & manufacturing development (EMD), and be included in milestone decisions.”**
  - **Prioritize U.S. sourcing of critical EM by including critical EM in new legislation requiring domestic sourcing for critical chemicals**
  - **Increase deliberate use of Government-owned capabilities by amending 10 USC 2563: “Articles and services of industrial facilities: sale to persons outside the Department of Defense” to allow GOGO facilities to collaborate with private industry for energetic materials and components**
  - **Adjusting DoDI 5160.68 to include Provision of Industrial Facilities (PIF) funding eligibility for GOGO plants**



# Summary and Path Forward

- **Kinetic weapons that utilize energetic material effects are a primary means to deter adversary aggression and win engagements. Therefore, EM and EMS are critical to US national security.**
- **Implementing the Energetics Plan recommendations described here are vital to maintaining technological superiority in energetics technology, to efficiently transitioning energetics to operational use, and maintaining a robust industrial base.**
- **OUSD R&E will work with our partners across DoD to influence POM 2024-2029 and implement recommendations within the PPBE process.**



# Mapping: Challenges/Recommendations

	LACK OF STRATEGIC DIRECTION & COORDINATION	INABILITY TO TRANSLATE EMERGING TECHNOLOGIES	WORKFORCE CHALLENGES	LACK OF RESOURCES TO MATURE EM/EMS	LACK OF INTEGRATED M&S	MISSING COMPREHENSIVE UNDERSTANDING	MISALIGNED S&T AND ACQ. TIMELINES	ANTIQUATED T&E METHODS AND INFRASTRUCTURE	POLICY & REGULATION IMPEDIMENTS	LACK OF A CENTRALIZED INDUSTRIAL MASTER PLAN	SIGNIFICANT SUPPLY CHAIN ISSUES	SPORADIC DEMAND SIGNAL	LACK OF COMMERCIAL R&D
STRATEGIC ENERGETICS RESPONSIBLE AUTHORITY	•	•		•	•	•	•		•	•			
ESTABLISH AN EM COMMON OPERATING PICTURE	•	•		•		•	•					•	
ACCELERATE ENABLING M&S CAPABILITIES		•			•			•					
ESTABLISH EMS PUBLIC/PRIVATE PARTNERSHIP	•	•	•										•
EMS WORKFORCE DEVELOPMENT PROGRAM	•	•	•										
IMPROVE EM POLICY & REGULATION	•	•		•					•				
BA4 EMS DEVELOPMENT PROGRAM	•	•		•			•	•					
MODERNIZE TEST & EVALUATION			•		•			•					
SUPPLY CHAIN ASSESSMENT AND TOOL						•				•	•	•	
ESTABLISH EM PILOT-SCALE PLANTS			•							•	•		
COORDINATE A MANUFACTURING MODERNIZATION PLAN			•					•		•	•	•	•