

23rd Annual Science and Engineering Technology Conference

**Arun Seraphin
Executive Director
NDIA Emerging Technologies Institute
May 23-25, 2023
San Antonio, Texas**

NDIA is the preeminent defense industrial association connecting government and industry through strategic forums and proactive policies to align a modern, resilient, and diverse industrial base with the capabilities required to ensure the U.S. military's operational and technological competitive advantage.

NDIA BY THE NUMBERS



6 STRATEGIC PRIORITIES

- Advance Budget Stability
- Expand International Security Cooperation & Interoperability
- Gain Acquisition Agility & Regulatory Efficiency
- Promote Innovation in Technology & Process
- Foster Small Business Success
- Strengthen the DIB & Workforce



NDIA engages all **3** branches of government



1 MILLION
PAGE VIEWS ANNUALLY

3 AFFILIATE ORGANIZATIONS



AT THE HEART OF THE MISSION SINCE 1919



- HON. David Norquist – CEO & President
- Guy Walsh – New Chief Operating Officer
- Jen Stewart – Executive VP, Policy
- Arun Seraphin – New ETI Director

- Vital Signs (released Feb 2023)
- Hypersonics Supply Chain Report (released 5/11/23)

- Upcoming conferences:
 - CBRN Defense (7/24-7/26/23)
 - Undersea Warfare (9/18-9/20/23)
 - Future Forces/Fuze/Global Demilitarization (9/25-9/28/23)
 - NDIA ET Conference (8/28-8/30/23)

<https://www.ndia.org/events>

NDIA's 2023 Policy and Strategy Priorities

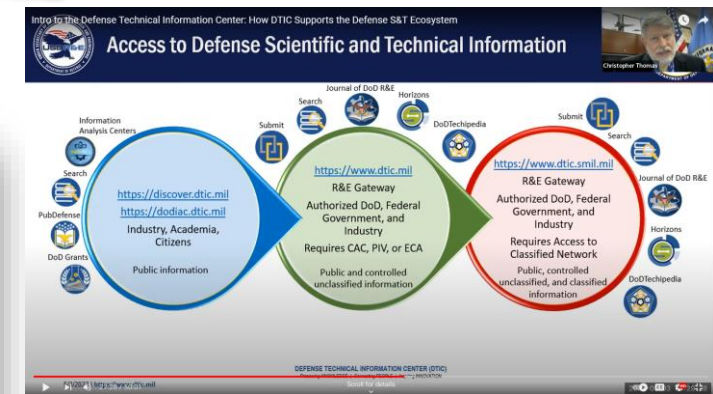
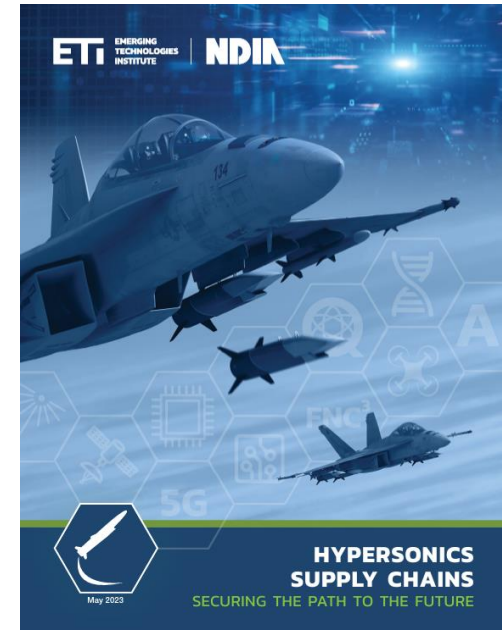


- Securing Budget Stability and Sufficiency
- Advancing DoD Digital Modernization
- Facilitating Foreign Military Sales Modernization and Technology Integration
- Restoring Industrial Readiness, Capacity, and Infrastructure
- Enabling More Resilient Supply Chains

- **Affiliate organization of the National Defense Industrial Association (NDIA)**
- **Launched in July 2021 to increase NDIA focus on emerging technologies, their impact on national security, and industry-government partnerships to win the global technology competition**
- **Deliver value to NDIA members, including traditional and non-traditional companies, on trends and opportunities in emerging technologies for national defense**
- **Staff delivers member value events, technical and policy analyses, and educational products to government and industry decision-makers**
- **Provide neutral forum for government-industry-academic exchanges on technical and technology policy matters**
- **Increase emerging technology content in other NDIA products, activities, and events**

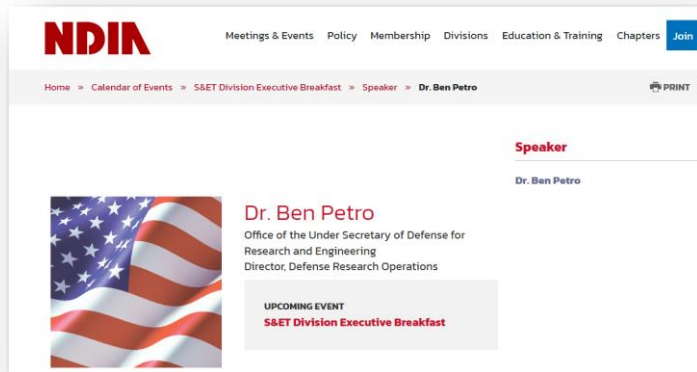
Current ETI Activities

- Future Supply Chains (Hypersonics and Directed Energy)
- Budget Request and Appropriations Analysis
- Rapid Technology Capability Adoption
- Software as a Modernization Priority
- Government-Industry Data Sharing for CBM+
- Microelectronics Modernization Report
- HBCU/MSI Partnerships
- High Skills Immigration for National Security
- Policy Considerations for Artificial Intelligence
- Tech 101 Educational Series
- Emerging Tech Horizons Podcast
- Partnering within and outside NDIA



Collaboration with Divisions

- S&ET: Working with HBCUs Webinar
- S&ET: Executive Breakfast Seminar - Dr. Ben Petro (Working with DOD Labs)
- S&ET: Working with HSIs Workshop (with Air Force)
- Space: DIU State of Space Industrial Base Webinar
- Logistics: Data Sharing for CBM+ Workshop
- Support for Division Meetings and Conferences



Emerging Technologies Supply Chain Study

NDIA

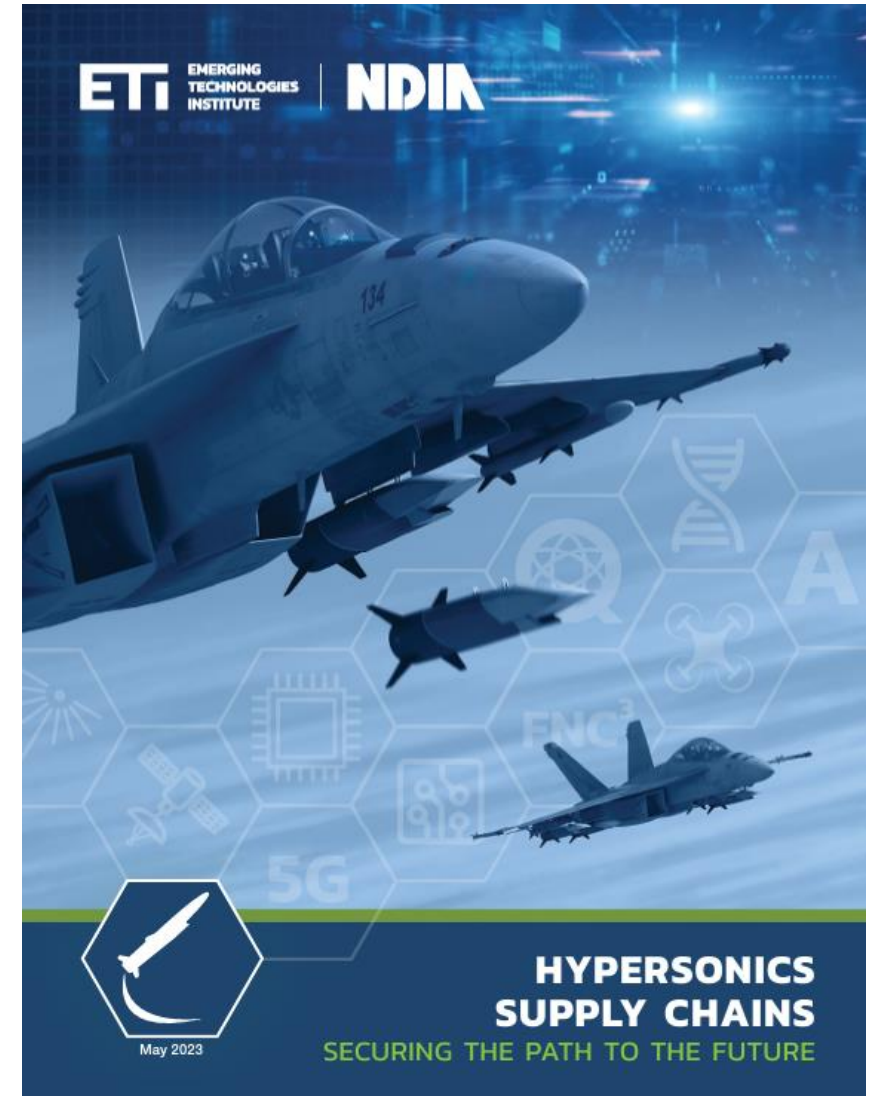
Goals: Assess the state of defense emerging technology supply chains and provide policy recommendations for their development, health, and resilience

Current Scope: Hypersonics & Directed Energy

Status: Hypersonics report published last week. Directed Energy working groups currently underway and will finish in early Summer.

Methodology (Hypersonics):

- Partnered with University of Maryland Supply Chain Management Center
- Convened 8 working groups, comprised of 22 key stakeholders from industry, government, and academia
- Conducted interviews with representatives at all levels of the hypersonics supply chains
- Compiled key findings from working groups, interviews, UMD research, and internal research into final report
- Submitted report to a distinguished peer review committee and external reviewers prior to publication



www.ndia.org/hypersonics

Hypersonics Study: Key Findings

- **Assessment:** Current supply chains, including manufacturing base, supply of critical materials, testing infrastructure, and workforce are insufficient to affordably field hypersonic weapons at scale.
- **Critical Raw Materials & Goods**
 - U.S. is reliant on China for certain critical minerals
 - Supply base of high-temperature materials is relatively small and fragile
 - Limited DOD-approved domestic suppliers for ammonium perchlorate
- **Manufacturing Base & Workforce**
 - Insufficient manufacturing base due to inconsistent demand signal
 - Insufficient testing infrastructure & personnel
 - Lack of hypersonic talent (e.g., issues with hiring & retention)
- **Supply Chain Security & Vulnerabilities**
 - Hypersonic supply chains face cybersecurity threats at all levels
 - China recruited talent from Los Alamos National Lab to work on their hypersonics programs
- **International Partnerships**
 - Existing international partnerships on hypersonics are limited but opportunities exist to strengthen supply chains by expanding international partnerships

Key Recommendations:

- DoD must provide a consistent demand signal to industry
- Further investment needed in high temperature materials such as carbon-carbon
- DoD should continue pursuing an air-breathing hypersonic vehicle system as part of its development plan to expedite manufacturing base growth and transfer critical knowledge from more senior hypersonic talent to new talent
- Academia should be leveraged for educating mid-level talent in hypersonic-adjacent fields to address workforce shortages
- OUSD A&S should ensure the acquisition workforce is adequately prepared for hypersonic procurement at scale through education and training
- U.S. government should look to Canada and Australia to diversify critical raw material supply and expand testing partnerships

Tech 101 series

- Educational series to provide technical market awareness to NDIA members on a variety of emerging technologies
- Monthly release schedule
- Aimed at non-expert audience
- **Topics include:**
 - Hypersonics 101
 - Quantum Science 101
 - Microelectronics 101
 - Blockchain 101
 - Directed Energy 101
 - Additive Manufacturing 101
 - Cloud Computing 101
 - Digital Engineering 101
 - Quantum Computing 101
 - 5G 101



Each averages 200 registrants, 125 attendees live, and 400 YouTube views

Emerging Tech Horizons Podcast

- **Podcasts on Technical and Policy Issues**
 - China and Emerging Technologies
 - Quantum Computing
 - Blended Wing Body Configurations
 - Operational Energy
 - Working with HBCUs
 - Understanding the CHIPS and Science Act
 - ...and many more
- **Released biweekly on YouTube, Spotify, and Apple Podcasts**
- **Sponsorship opportunities**
- **Viewership:**
 - 2023 to date - 25000+ views – 10 podcasts released so far
 - 2022 – 25 podcasts
 - 2021 – 9 podcasts
- **Using podcast to promote NDIA and ETI events and products**



Emerging Tech Horizons Podcast Episode with AI Shaffer



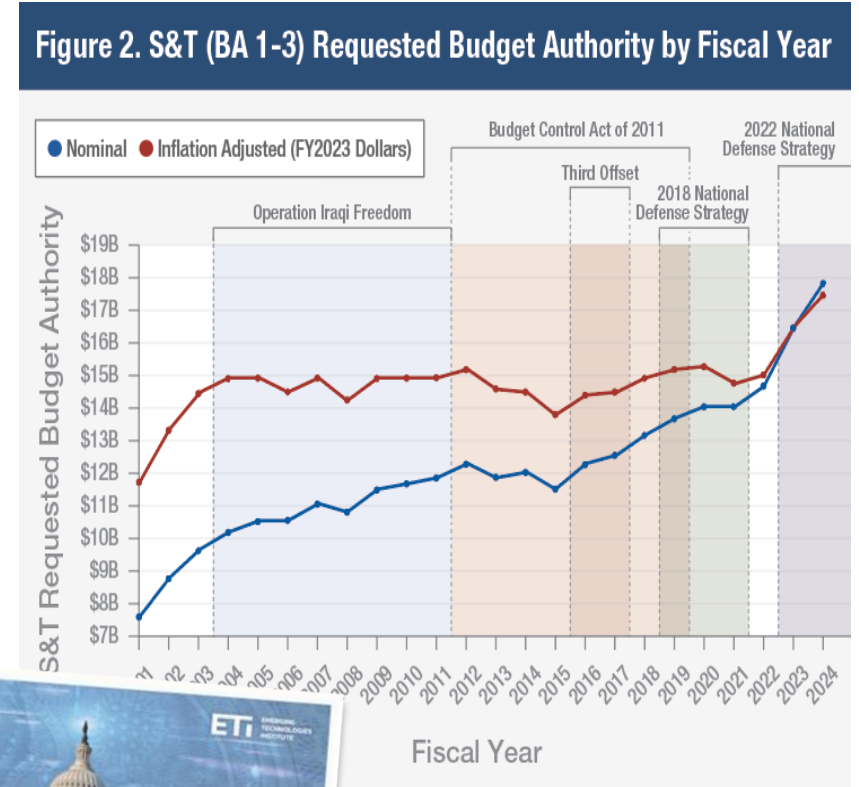
Emerging Tech Horizons Podcast Episode On the Road at SOFIC

Budget Request and Appropriations Analysis (S&T Funding Data)

How: Analyzing multiple budget justification and appropriations data sources; Developing software tools to process more data

Findings:

- **Doubling down on emerging technologies:** S&T budget requests were flat from FY2003 to FY2015. Since FY2016, requests have grown substantially
- **When defense topline grows, S&T grows slowly.** Money goes towards near-term threats
- **When defense topline shrinks, S&T is protected.** Long-term investments are protected
- **Congress pays attention:** Congress always appropriates more for S&T than what DoD requests
- **DoD is not reaching stated internal target:** DoD's S&T requests do not reach 3% of the DoD topline



Rapid Technology Capability Adoption

(Schmidt Futures)



What We Are Exploring:

- Provide recommendations and guidance to decision makers focused on developing the means for rapidly delivering commercial capabilities to the DoD

How:

- Identify areas in which the DoD can execute rapid acquisition activities, especially to take advantage of emerging technologies
 - Generate advocacy strategies to support implementation of recommendations by Congress and the DoD
 - Advise policy or legislative changes
 - Advise budgetary or resource changes, or financial management policy changes

Early Insights:

- Department of Defense struggles to deliver new technology to the warfighter in a timely manner, even when solutions are already available in the commercial sector
- There are several barriers and challenges to adopting new capabilities in a rapid manner
 - Policy and Requirements
 - Behavior
 - Meeting the needs of the oversight community (testing, auditing, Congress, ...)
- There are several examples of successful rapid deployment of capabilities to include Operation Warp Speed

Next Steps:

- Initiate research/conduct interviews on OWS and other rapid deployment efforts
- Identify barriers/challenges and recommend mitigations
- Make policy change recommendations
- Develop a Rapid Technology Capability Adoption Playbook

Policy Considerations for Artificial Intelligence

What We Are Exploring:

- Exploring how the development of a regulatory framework can be best supported by the technical, military, and policymaking communities

How:

- Interviews with autonomy experts from NDIA membership with commercial, academic, and government backgrounds
- Policy analysis (e.g., DODD 3000.09, Responsible AI Strategy, and 5 Principles of AI)
- Publications in Carnegie Council on Ethics in International Affairs, National Defense Magazine, and stand-alone paper
- Engagement with Congress

Early Insights:

- The technical community is eager for policymakers and end-users to have a deeper understanding of technical aspects of autonomy and their policy implications
- Previous technology policy regimes were helped by an open dialogue between communities
- Few opportunities for sustained dialogue and collaboration between technical, military, and policymaking communities
- Need to have a dialogue and policy formulation around real world likely scenarios/continuously learning systems
- Practitioners must understand data sources and biases

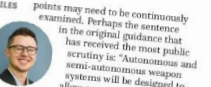
EMERGING TECHNOLOGY HORIZONS BY WILSON MILES Autonomous Weapon Policy Receives Much Needed Update

The adoption of emerging technologies for national defense presents challenges and opportunities not just to the developers and operators, but to policymakers as well. There is no clearer example of this than the ongoing debate over the potential use of autonomous weapon systems on the battlefield. The Pentagon recently updated Directive 3000.09 — its guiding autonomy in weapon systems — to reflect rapid developments over the past few years. This demonstrates the ongoing commitment of U.S. policymakers to be forward-looking in establishing responsible constraints, as well as a shared understanding of the military relevance, technical realities, threats and strategic implications of autonomous weapon systems. Directive 3000.09 created a regulatory framework that inserted policy considerations into the military's process before formal development. The update to this policy clarifies the roles and responsibilities of the technical, policy, and military communities who manage autonomous systems' maturation and eventual use. Of note is the requirement for a formal review of autonomous weapons systems so their use is consistent with governing policies. This includes operational capabilities and limits, system safety and reliability, and will be conducted by the undersecretaries of defense for policy, research and engineering, and acquisition and sustainment, in addition to the vice chairman of the Joint Chiefs of Staff.

It is important for policies to avoid focusing on theoretical examples and instead be rooted in specific concept of operations or realistic mission use cases. Much of the current discourse surrounding autonomous weapon systems occurs at an abstract level. Acknowledging this, 3000.09 now requires systems to be designed to "complete engagements within a timeframe and geographic area, as well as other applicable environmental and operational parameters."



This policy balances abstract operational need to be tactically useful, and the technical reality of engineering an autonomous system. This effectiveness when writing code and to meet well-designed and bounded military use cases. Prohibiting the fielding of systems whose operations are unbounded by time and geographic data consistent with these systems. Machine learning models can be opaque, making it difficult for laymen to understand a system's rationale for a given response. In some unforseen errors in activities like target identification. To address this, the policy states that "technologies available by and explainable by relevant personnel," which is crucial for establishing trust in the machines. While 3000.09 articulates which Defense Department organization is responsible for developing requirements for data collection, the implementation of the new guidance's regulation of the data itself. It neither describes nor differentiates between types of data — such as synthetic data — which is increasingly used to train systems in situations where real-world data is limited or unavailable. Another challenge is the lack of a technically defined boundary between autonomous and semi-autonomous systems that would allow regulation to distinguish between the system is deployed. Once a system is deployed, there is no method for inspectors to ensure compliance with existing policies. As such, it is even more critical to understand the biases and sources of the data to ensure deployment will be consistent with ethical norms and policies. Though the 3000.09 update makes significant strides, some policy



points may need to be continuously examined. Perhaps the sentence in the original guidance that "has received the most public scrutiny" is "Autonomous and semi-autonomous weapons systems will be designed to allow commanders and operators to exercise appropriate levels of human judgment over the use of force." This somewhat nebulous and evasive can argue that pursuing autonomous weapon systems without putting binding legal rules in place may lead to unintended consequences. The director's language regarding the "appropriate levels of human judgment" is ambiguous and any action will be consistent with acceptable rules of engagement. The Emerging Technologies Institute is currently exploring how the development of complex technical regulatory regimes can be best supported by the technical, policy and user communities. Our Industrial Association member company experts have shown that the technical community is eager for policymakers and end-users to have a deeper understanding of the technical aspects of autonomy. At the same time, technical training and education often omits consideration of policy, including potential dual-use, regulatory or ethical considerations. Moreover, there are few opportunities for sustained and detailed dialogue and collaboration between the communities, providing an opportunity to include each group in the typical discussion forums and ensure equal voices from all autonomous technology, the Defense Department is correctly seeking to develop and leverage it to support national security missions. The update to 3000.09 is a positive step for the global leader in developing and deploying new autonomous systems in a lawful manner. **ND**

Wilson Miles is an associate research fellow at NDIA's Emerging Technologies Institute. His membership from the community at the NDIA Emerging Technologies Conference and Exhibition in Washington, D.C., Aug. 25-30.

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Software as a Modernization Priority

What We are Exploring: Provide NDIA member feedback on how DOD should structure its Software Modernization priority area

Products:

- November 2022 Workshop co-hosted with Carnegie Mellon University (CMU) Software Engineering Institute (SEI) for NDIA industry & academic members, along with R&E and Service technical staff
- 25 attendees representing the defense industrial base, academia, U.S. government, and allies, including Google, Palantir, Rebellion Defense, Northrop Grumman, Singapore, and Australia
- Workshop summary report co-written with CMU SEI
- Workshop summary report foreword written by Thomas W. Simms, Acting Principal Deputy Director, Systems Engineering and Architecture, Office of the Under Secretary of Defense for Research and Engineering

Example Recommendations:

- DoD should create a process for surfacing and prioritizing long-term software-specific needs, both content (i.e., mission-supporting) and enabling, as a foundation for software S&T investments;
- DoD should prioritize the development of capabilities that will enable the maximum possible use of commercially-driven AI-enabled tools.
- DoD should focus on tools that use automation to minimize the technical debt associated with legacy code.
- DoD software workforce plans should deliberately seek to promote both retention of internal expertise and “leavening” with rotational positions for commercial practitioners.
- DoD should explore standardization of requirements for evidence about software systems.

Status: Report to be published in later Spring, Podcast to be used to highlight report rollout

Emerging Technologies Defense & Exhibition Conference

NDIA

August 28 – 30, 2023, JW Marriott, Washington, D.C.

Focus Areas: Game Changing Technologies, Counter UAS, Contested Logistics, Operational Energy

- Business Opportunities Panels from PMs and PEOs
- Operational Challenges
- Technology Briefs
- Keynote Speakers from DOD and Industry

Abstract Portal for NDIA Member Technology Presentations open until June 16

Registration is open now

Display and Sponsorship Opportunities



Work with us!

- **People**
- **Joint workshops**
- **Webinars, Podcasts, Tech 101 Events**
- **Future Study Ideas**
- **2024 conference collaboration**