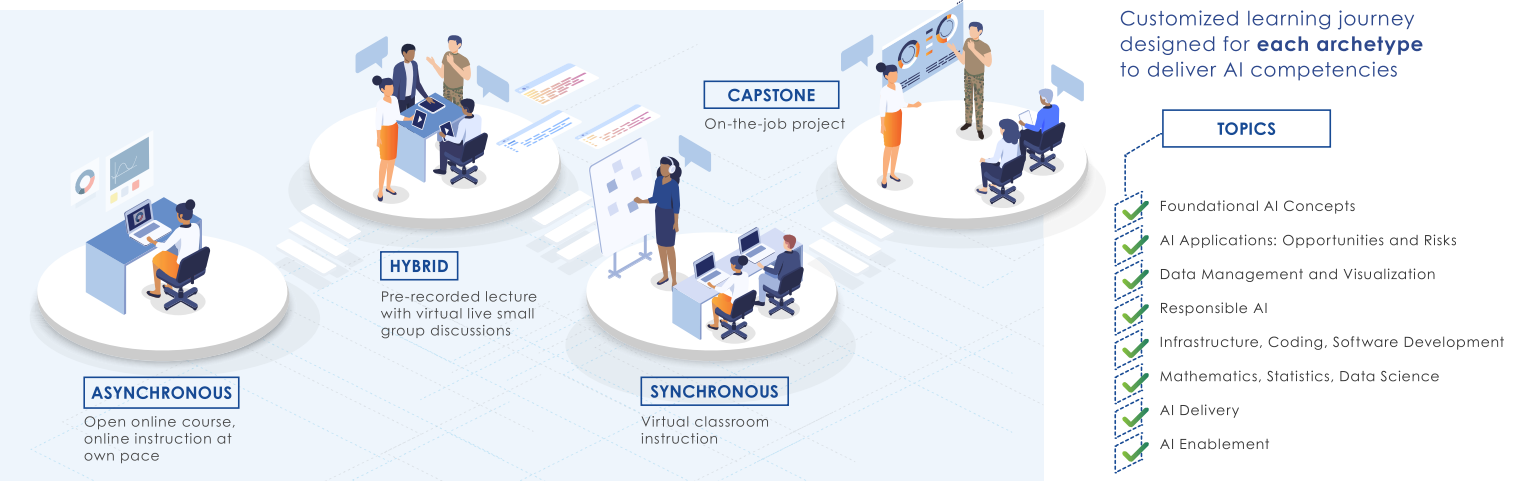
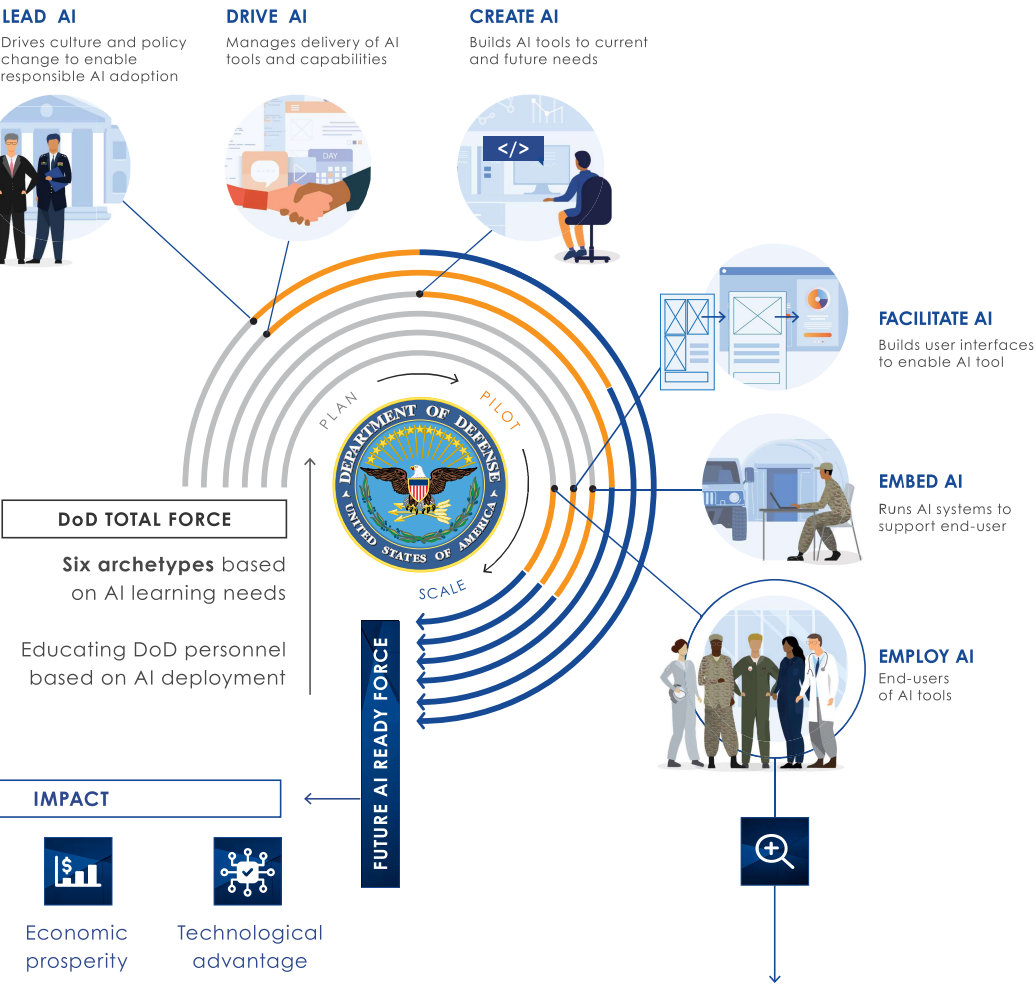


DoD AI EDUCATION STRATEGY

Cultivating an
AI ready force to
accelerate adoption



DoD AI Education Strategy

The Department of Defense (DoD) is in the midst of a historic technological transformation. With guidance from the DoD AI Strategy and the Digital Modernization Strategy, DoD will apply technological innovations to transform all functions of the Department, thereby supporting and protecting U.S. servicemembers, safeguarding U.S. citizens, defending allies and partners, and improving the affordability, effectiveness, and speed of our operations. As part of this broader technological transformation, there is a strategic imperative for the Department to adopt Artificial Intelligence (AI) at speed and at scale.

The future of AI in the DoD relies on the Department's ability to build and develop a workforce for the digital era. AI is a human-centric endeavor – developed by people, for people – and because humans will ultimately make the decisions that are informed by AI capabilities, an AI ready force is essential to delivering AI at scale. This includes both technical and non-technical roles, across all grades and ranks, civilian and military.

However, there is a global war for talent. DoD is not yet postured to compete with industry in hiring the large numbers of experienced, top-tier AI talent needed to build and deploy AI across the DoD. As a result, DoD must prioritize educating and training its incredibly diverse and talented workforce to deliver AI capabilities at scale across the Department.

The large scale of the DoD workforce, though, requires targeting and sequencing education and training investments with a focus on responsibly managing taxpayer dollars. As such, new investments will be directed toward the groups that are critical to the priority objective of delivering AI capabilities at scale: DoD Senior Leaders and DoD Integrated Product Teams (IPTs). Senior leadership will catalyze broader process and cultural change, enable modifications and reforms to policy, and send a top-down demand signal to accelerate AI adoption. IPTs are multidisciplinary groups of Product Managers and AI developers whose roles are central to delivering AI capabilities.

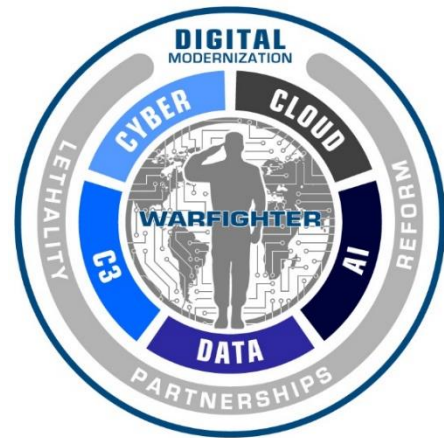
DoD is beginning the implementation phase of the *AI Education Strategy* by kicking off a pilot in October 2020 with an initial cadre of 84 Acquisitions and Requirements professionals from across the DoD. This cohort will go through an intensive program to be upskilled on AI technologies and how to define requirements and procurement capabilities on behalf of DoD. The outcomes and feedback from the initial pilot will be used to quickly adapt and scale the program across the Department.

DoD stands at a critical juncture in history, where adopting AI capabilities at speed and scale is essential to maintain military advantage. DoD must develop world class AI practitioners to make AI real at the Department. Investments in AI education and training will serve the immediate DoD requirements while simultaneously increasing the U.S. national AI workforce capacity, bolstering U.S. security and economic competitiveness. Large-scale AI culture and competency development requires targeted upskilling across the entire DoD workforce to unlock the potential of its most precious resource, its people. Establishing an overarching *AI Education Strategy* for the DoD workforce is a pivotal step in supporting the Department's transformation into the digital age and widescale adoption of AI.

2020 Department of Defense Artificial Intelligence Education Strategy

Delivered in Fulfillment of the Requirements outlined in Section 256 of the National Defense Authorization Act for Fiscal Year 2020 (Public Law 116-92).

September 2020



This strategy is submitted in response to Section 256 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2020 (P.L. 116-92).

Section 256 states:

SEC. 256. ARTIFICIAL INTELLIGENCE EDUCATION STRATEGY. (a) **STRATEGY REQUIRED.**—(1) **IN GENERAL.**—The Secretary of Defense shall develop a strategy for educating service members in relevant occupational fields on matters relating to artificial intelligence. (2) **ELEMENTS.**—The strategy developed under subsection (a) shall include a curriculum designed to give service members a basic knowledge of artificial intelligence. The curriculum shall include instruction in— (A) artificial intelligence design; (B) software coding; (C) potential military applications for artificial intelligence; (D) the impact of artificial intelligence on military strategy and doctrine; (E) artificial intelligence decision making via machine learning and neural networks; (F) ethical issues relating to artificial intelligence; (G) the potential biases of artificial intelligence; (H) potential weakness in artificial intelligence technology; (I) opportunities and risks; and (J) any other matters the Secretary of Defense determines to be relevant. (b) **IMPLEMENTATION PLAN.**—The Secretary of Defense shall develop a plan for implementing the strategy developed under subsection (a). (c) **SUBMITTAL TO CONGRESS.**—Not later than 270 days after the date of the enactment of this Act, the Secretary of Defense shall submit to the congressional defense committees— (1) the strategy developed under subsection (a); and (2) the implementation plan developed under subsection (b).

The below table provides the breakout of each section which the Strategy addresses as outlined in Section 256 of the NDAA.

Requirements	Required Instruction	Page number (Competency)
(a) Artificial Intelligence Education Strategy	(a) Curriculum	8-9, 20, 25, 30, 35, 40, 45
	(A) Artificial intelligence design	8 (AI enablement)
	(B) Software coding	8 (Software dev. & coding)
	(C) Potential military applications	8 (Foundational concepts)
	(D) Impact of AI on military strategy and doctrine	8 (AI delivery)
	(E) Artificial intelligence decision making via machine learning and neural networks	8 (Foundational concepts)
	(F) Ethical issues relating to artificial intelligence	8 (Responsible AI ¹)
	(G) Potential biases of artificial intelligence	8 (AI applications)
	(H) Weakness in artificial intelligence technology	8 (AI applications)
	(I) Opportunities and risks	8 (Foundational concepts)
	(J) Any other matters the Secretary of Defense determines to be relevant	8 (Data management and visualization, Mathematics and statistics)
(b) Implementation Plan	Plan to implement subsection (a)	11-14 (Lines of effort, key performance indicators, milestone schedule)

¹ Ethical considerations are a key part of the *Responsible AI* program

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1 Executive Summary

Fiscal Year 2020 National Defense Authorization Act Section 256 requests the Secretary of Defense develop a strategy for educating service members in relevant occupational fields on artificial intelligence (AI). The strategy is to include a curriculum² designed to give “service members in relevant occupational fields” a basic knowledge of AI. The Department of Defense (DoD) elected to expand this mandate to cover the Total Force (to include the Active Component, Reserve Component, and civilian employees) in all career fields, as personnel in both technical and non-technical roles must work side-by-side to deliver and employ AI capabilities across the Department.

DoD’s wide range of missions, complex personnel systems, lack of fully-deployed AI enterprise infrastructure and platform services, and relatively small but growing number of deployed AI use cases³ drove a set of core assumptions used to formulate this strategy and implementation plan. These assumptions are:

- DoD is not postured yet to compete with industry (e.g., compensation, career paths, retention, or access to open-source tools) in hiring the large numbers of experienced, top-tier AI talent needed to build and deploy AI across the DoD;
- New investments in education and training should be directed toward enabling delivery of AI capabilities at scale through the education and training of cohorts outside of the DoD’s current cadre of AI researchers;
- The large scale of the DoD workforce, as well as meeting the tenets of the Digital Modernization Strategy, require integrating and targeting education and training investments with a focus on managing costs; and
- DoD investments in AI education and training must serve both immediate DoD requirements and, over the medium-term, increase the U.S. national AI workforce capacity to ensure any new investments pay long-term dividends to U.S. security and economic competitiveness.

In responding to Section 256, DoD segmented its entire workforce into “archetypes;” those personnel with similar AI education and training needs. DoD then used the archetypes as an analytical framework to inform key strategy decisions, including how DoD should prioritize and sequence new actions and investments, manage costs, and establish foundations needed to achieve a long-term vision for the Department’s digital workforce.

In support of the DoD Chief Information Officer’s (CIO) Digital Modernization Strategy, DoD identified the priority objective for the *AI Education Strategy*: to accelerate the delivery of AI capabilities at scale. This priority objective will focus the Department’s early actions and investments into four areas. First, DoD will prioritize AI awareness for senior leaders to build support, accelerate adoption, and catalyze broader change. Second, DoD will upskill the segments of the workforce most directly involved in

² Curriculum elements include: AI design, software coding, potential military applications of AI, AI decision-making via ML and Neural Networks, ethical issues relating to AI, the potential biases of AI, opportunities and risks, any other matters the Secretary of Defense determines relevant.

³ Use cases correspond to a set of behaviors that the AI system may perform in interaction with its actors, and which produce an observable result that contribute to its goals (e.g., preventive maintenance optimization)

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delivery of AI capabilities into multidisciplinary groups of personnel who comprise Integrated Product Teams (IPTs).⁴ Third, DoD will prioritize establishing its broader vision for the digital workforce and seek to clarify how AI relates to other fields such as software engineering, cyber, and IT. This vision will help the Department reduce redundancies and inefficiencies across disciplines. Finally, DoD will certify and track the deployment and integration of an AI ready force across the Components. DoD assesses these four steps are critical to achieve the *DoD AI Education Strategy's* priority objective in the quickest amount of time and for the least amount of cost.

Supporting the *AI Education Strategy's* priority objective requires sequencing training and education to accelerate delivery of AI at scale while acknowledging resourcing and contextual limitations. In defining this sequencing plan, DoD recognized that it must delay training and education for AI and data technicians (who are an integral part of the IPTs) to coincide with the deployment of AI enterprise infrastructure and platform services. Training a cadre of AI and data technicians before DoD has fielded AI enterprise infrastructure and platform services that are necessary for these personnel to use their skills would be early-to-need. As infrastructure and platform services become more widely available, DoD plans to scale education and training investments to all technical personnel on an IPT.

DoD also recognized that it must pace the training of end-users with the deployment of AI capabilities. These users should receive application-specific training on relevant AI-related concepts at the same time as capabilities are deployed so that they understand the strengths and limitations of AI capabilities.

At full implementation, DoD's *AI Education Strategy* will enable DoD's Digital Modernization Strategy, the National Defense Strategy, the National Security Strategy, and DoD's AI Strategy. It also has the potential to grow the U.S. national AI workforce capacity as transitioning DoD personnel gain highly-relevant skills needed to be successful in the digital economy. Coupled with the development of a talent certification and tracking program, the JAIC plans to measure DoD's progress as it integrates an AI-ready force. The JAIC will seek to assist DoD Components in rationalizing and consolidating, where possible, existing AI educational offerings and services across DoD.

2 Strategic Context and Assumptions

As the United States looks to preserve and extend its competitive military advantage over potential adversaries, the Department must continue to urgently implement its digital transformation strategy and adopt AI technologies at rapid speed and scale. Successful adoption of AI technologies into all aspects of military operations requires a fully-resourced, highly-educated and trained workforce, a coherent data strategy and associated platform services, and the best available technology. Leveraging DoD's long-standing culture of excellence in education and training and its diverse and talented workforce, DoD will field an elite and world-class AI-ready force by implementing and scaling this *AI Education Strategy*.

Four core assumptions underpin the Department's strategy for AI education and training:

DoD is not yet postured to compete with industry to hire the large numbers of experienced, top-tier AI talent needed to build and deploy AI across the DoD. AI and other digital technologies will be critical to fight and win the wars of the future. AI talent is in short supply and commercial companies have a distinct advantage over DoD with respect to recruitment, acquisition, and retention of top-flight AI

⁴ Integrated Product Teams addressed in Section 4, Subsection ii.

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talent.⁵ DoD cannot afford to compete with private industry for enough AI technical talent to build and deploy required capabilities at scale.

New investments should be directed toward enabling delivery of AI capabilities at scale through the education and training of cohorts outside of the DoD's current cadre of AI researchers. DoD's research institutions boast a small cadre of deep technical expertise with a history of world-changing innovations. These researchers are, by definition, experts in their field. However, due to the high-demand in commercial talent supply, and the associated costs of this workforce population, DoD cannot achieve its digital transformation goals simply by increasing its cadre of world-class researchers. DoD must upskill cohorts beyond the confines of AI researchers to deliver AI at scale.

The scale of the DoD workforce and its ambitious Digital Modernization Strategy require integrating and targeting education and training investments with a focus on managing costs. While a large-scale upskilling program in industry means training 100,000 employees⁶, a similar program for the DoD means delivering education and training to a large workforce. DoD must accomplish this without overburdening its financial and manpower resources, which means setting clear priorities and delaying investments in education and training for certain workforce segments until absolutely necessary. For example, if DoD's AI Strategy is successful, the vast majority of DoD's future workforce will use AI-enabled capabilities. Instead of training the entire workforce on AI applications in the near-term, DoD must deliver education and training for its end-user population at pace with the actual deployment of AI capabilities.

New DoD investments in AI education and training must serve both immediate DoD requirements and, over the medium-term, increase the U.S. national AI workforce capacity to ensure any new investments pay long-term dividends to U.S. security and economic competitiveness. DoD will seek to create new cadres of AI workers, comprised of both military and federal civilian personnel, who can enhance Department capabilities and, as they transition to positions outside of federal service, support private industry and help offset the scarcity of AI talent.

These assumptions will guide and frame the Department's approach to training and educating its personnel in AI fields over the next 5-7 years. Establishing this overarching *AI Education Strategy* for the DoD workforce is a pivotal step toward ensuring the U.S. military can fight and win future wars against peer competitors. This strategy rationalizes and consolidates, where possible, existing AI educational offerings and services across DoD to leverage existing Component plans. The Department can achieve this critical endeavor in a way that minimizes the burden on taxpayers while simultaneously providing broader benefits to our economic and technological might, all within the scope of defending our nation's people and their security, prosperity, and freedom.

3 Scope

This strategy takes a Total Force approach, recognizing the need for cross-DoD coordination and acknowledging the importance of key dependencies such as enterprise infrastructure and platform services.

Total Force Approach. DoD's *AI Education Strategy* expands the scope defined by the NDAA Section 256 requirement. The expanded scope takes a Total Force approach by focusing on the Active Component, Reserve Component, and civilian employees, as they work side-by-side identifying,

⁵ National Security Commission on Artificial Intelligence, Interim Report, Nov. 2019.

⁶ Anand Chopra-McGowan, How Companies and Governments Can Advance Employee Education, Harvard Business Review, Sept. 2019.

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integrating, adapting, and employing AI. DoD's *AI Education Strategy* also addresses all career fields because both technical and non-technical roles play an important part in the Digital Modernization Strategy.⁷ However, select roles will require more specialized technical training and education.

Cross-DoD coordination. DoD Components are developing AI education programs to address their unique requirements, but a common set of AI skills is needed across the Department. Currently, DoD lacks a consistent approach to coordinate, assess, or track AI skills. Simultaneously, related DoD-wide initiatives are underway to address other aspects of the larger digital workforce in areas such as cyber and IT, software engineering, and product management.^{8,9,10,11} This strategy seeks to coordinate with the broader digital workforce to pursue an enterprise approach¹² to reduce duplicative pursuits and capture the efficiencies of delivering AI capabilities at scale.¹³

Infrastructure and platform services. DoD's AI workforce needs adequate technical infrastructure to support the procurement and delivery of AI capabilities at scale. This infrastructure must support realistic DoD-specific training opportunities for its personnel and lower the technical barriers to AI adoption. Over time, the JAIC's infrastructure and platform services will provide key training capabilities in support of the Secretary of Defense's Joint Operational Training Infrastructure (JOTI) Strategy and will facilitate on-the-job training. JAIC intends to field its platform services to all Service Academies and DoD universities so that DoD students are able to train in a real DoD environment.

4 Theory of Victory – Four Key Pillars for Success

A key strategy imperative is to articulate the theory of victory; that is, articulating the understanding of how decisions and actions taken increase the probability of achieving the desired objective. Therefore, in support of the *AI Education Strategy*'s priority objective of accelerating the delivery of AI capabilities at scale, DoD believes near-term actions and investments in the four following areas are most likely to result in achieving the desired objective in the quickest amount of time and for the least amount of cost.

- i. ***Prioritize AI awareness for senior leaders*** to build support, accelerate adoption, and catalyze broader change. Senior leaders must understand what AI can do for defense, how to create organizational AI and data management strategies and policies, how to employ AI-enabled manpower, and how to make appropriate change management and resource allocation decisions for improved efficiencies made possible by AI adoption. By prioritizing the AI awareness of leadership, DoD can build momentum such that its senior leaders can be drivers of effective and positive culture change through scaling the identification, creation, and adoption of AI use cases.

⁷ The Joint Chiefs of Staff Vision and Guidance for Professional Military Education & Talent Management outlines the need to develop “practical warfighting skills” across the Joint Force of which AI will be an increasingly important competency.

⁸ DoD Directive 8140.01, Cyberspace Workforce Management, Jul. 2017.

⁹ Sean Robson et al., Software Acquisition Workforce Initiative for the Department of Defense, RAND Corporation, 2020.

¹⁰ DoD Digital Modernization Strategy, Jul. 2019.

¹¹ Complimentary language can be found in the other FY20 NDAA workforce responses that highlight a preference in a digital workforce that includes software, AI, and engineering.

¹² Efforts are underway to deploy enterprise solutions for Human Resources Information Services to address long term need for integration.

¹³ Summary of the 2018 Department of Defense Artificial Intelligence Strategy.

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- ii. **Create a cadre of Integrated Product Teams (IPTs)¹⁴** to deliver AI capabilities. The *AI Education Strategy* prioritizes multidisciplinary groups of personnel who will have the greatest near-term impact for accelerating the delivery of AI capabilities. The roles that make up IPTs are central to this goal; therefore, early education efforts will be focused here to ensure adequate talent exists to deliver AI capabilities as the pace of adoption accelerates. While DoD must also train its end-users to ensure they understand the limitations of AI systems and applicability of models in real-world contexts, such training must take place when fielding new applications and capabilities delivered by IPTs.
- iii. **Create a common foundation for DoD's digital workforce** to enable integration, Joint effects, identification of overlaps and inefficiencies across disciplines, and gaps in training an AI-ready force. Recognizing that the skillsets, experiences, and use case exposure across the DoD workforce varies widely, DoD's *AI Education Strategy* must describe its workforce and the role of AI within the broader context of the definition of the Department's digital workforce, including software engineering, cyber, and IT. This goes beyond individual competencies to include training the workforce on the technology foundations already in place within the Department, especially the DoD's Joint Common Foundation (JCF). Foundational concepts that are standardized across the Department, yet flexible for application within the Components, set the necessary conditions for maximizing reuse and collaboration and delivering AI at scale.
- iv. **Certify and track AI talent** to enable deployment and integration of an AI ready force across the Components. Scaling AI education and training needs to be complemented by an acceleration of use case adoption across the Department to provide crucial hands-on learning. Methods to identify talent with AI skills and experience will be implemented and utilization will be tracked to ensure the identified members of the AI workforce receive necessary on-the-job learning opportunities. By tracking AI talent, the Department can ensure the AI-ready force maintains its proficiency and Components have the capability to deploy personnel with the necessary skillsets across the full range of operations.

5 Workforce AI Awareness, Education, and Training Program

AI awareness, education, and training are fundamental to AI-ready force planning and management (see Figure 1). The *AI Education Strategy* seeks to advance AI understanding, knowledge, and skills of the Total Force. However, it does not address all aspects of DoD's human capital strategy for AI, nor does it negate the need for broader workforce planning and establishing manpower requirements across the DoD Components. The *AI Education Strategy* does, however, provide a common foundation of workforce archetypes, i.e., groups with like AI education and training needs. Concentrations within archetypes allow for tailored learning based on AI-related roles. Together, these are useful analytical tools for establishing similar educational requirements, understanding workforce sizing and shaping, and assisting in resource allocation decisions.

¹⁴ IPTs are composed of product managers, data scientists, AI/ML engineers, IT technicians, and UI/UX designers from the "Create AI", "Drive AI", and "Embed AI" archetypes.

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Figure 1. Workforce planning



DoD recognizes the importance of formal education, awareness, training, commercial partnerships, and on-the-job learning in relevant operational environments to keep pace with technological change and drive delivery of AI capabilities for DoD personnel. The learning program defines the critical elements for a DoD AI-ready force, from worker archetypes through consolidated learning journeys. The program is intended as a common foundation, with the explicit intent that Components can tailor the program to their unique mission and operational needs. The five key elements are: worker archetypes and concentrations, learning outcomes, competencies curriculum building blocks; and learning journey program design (see Figure 2). The following sections summarize the five key elements of the learning program. Additional archetype-specific details are included in the appendices.

Figure 2. Learning Program Value Chain







	Workforce Archetypes and Concentrations	Learning Outcomes	Competencies	Curriculum Building Blocks	Learning Journeys
Description of element	Clusters of workers grouped by common skill needs, not organizational function or role	Definition of what success looks like for each archetype as a result of T&E program	A minimal set of competencies to address the future AI knowledge, skills and abilities needed within DoD	Foundational elements of a curriculum needed to close the skill gaps outlined in the learning outcomes	Delivery of curriculum across time and modality to address the archetype-specific competency requirements and meet the defined learning outcomes

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5.1 Workforce Archetypes and Concentrations

The AI workforce framework (see Figure 3) synthesizes input from Components, external recommendations, and commercial best practices.

Figure 3. AI Workforce Archetypes and Concentrations

Archetype	Description	Concentration	Role Explanation
	Lead AI Decides policy and doctrine, including how AI tools can or will be used; builds AI vision and plan	Policy	• Creates overarching guidance on DOD AI use
		Command	• Ensures AI policy carried out by personnel they lead
		Agency/Function Lead	• Ensures AI policy carried out in non-combat agencies
	Drive AI Ensures appropriate AI tools and capabilities are developed and delivered across DOD	Acquisitions Manager	• Supports technology/capabilities through total life cycle
		Capability Manager	• Evaluates and develops force structure resources and reqs
		Technical Manager	• Defines the tech strategy across a project portfolio
		Product Manager	• Ensures the creation of AI-enabled tools, from start to finish
	Create AI Creates AI tools to meet current and future needs	AI Researcher	• Pushes DoD AI capability by preparing for future use cases
		AI/ML Engineer	• Builds, tests, codes, integrates, and delivers AI tools
		Testing & Evaluation Engineer	• Evaluates system capabilities, limitations, operational risks
		Data Scientist	• Applies AI tools to perform analytics and create solutions
	Embed AI Embedded with Employ AI, establishes AI systems and provides end-user support at tactical edge	Deployment Engineer	• Manages integration, deployment, and operation of AI systems
		Technician	• Deploys, maintains, adapts, and collects data for AI/ML systems at the tactical edge
	Facilitate AI Represents users to ensure appropriate AI tools are developed and delivered to address use cases	Product Owner	• Provides voice of customer; turns product vision into backlog
		UI/UX	• Designs AI tool interface for usability and accessibility
	Employ AI End-users of AI tools, provide feedback on and requirements for AI tools	Other Technical Experts	• Delivers discrete elements of system not specific to AI
		Operations	• Prepares for and delivers operational requirements
		Intelligence	• Gathers and analyzes info to support decision-making
		Logistics & Maintenance	• Enables troop / gear movement, maintain equipment
		Health	• Maintains health and wellbeing of the Warfighter
		Support	• Supports the Warfighter in non-combat requirements

Not all personnel who will execute DoD’s AI Strategy will have the same learning needs. Segmenting the population of learners into archetypes aligns the full DoD population into differentiated cohorts based on their engagement with AI. For example, senior leaders who will build AI support, accelerate adoption, and catalyze broader change are encompassed in the “Lead AI” archetype.

Each archetype has its own learning outcomes defined as an associated set of competency requirements and curriculum, and a tailored learning journey. Archetypes allow for differentiation in the AI education and training program across cohorts while keeping the offerings streamlined to implement at DoD-scale. Archetypes are not intended to replace military occupational specialties nor to be integrated into civilian personnel systems. Instead, they serve as a useful analytical tool to facilitate planning and implementation of the education and training program at scale.

Within each archetype are concentrations that allow for more tailored learning to accommodate different emphases given AI-related roles. Concentrations reflect that AI roles and applications vary across archetypes, and therefore competency requirements within each archetype may vary across concentrations. While the broader learning journey remains the same within an archetype, a concentration may warrant a different track to accommodate a range of technical requirements. For example, the strategy suggests investment in the “Create AI” archetype with the exception of the AI Researcher concentration, as the concentration is already well educated and funded by the DoD.







5.2 Learning Outcomes

A set of learning outcomes is defined for each archetype (see Figure 4). These outcomes define what an individual within that archetype should be able to accomplish with respect to AI at the end of the learning program. These outcomes are informed by Benjamin Bloom’s taxonomy, a framework for differentiating

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educational objectives across levels of complexity and specificity.¹⁵ The learning outcomes serve as a guide to determine competency requirements for each archetype.

Figure 4. AI Learning Outcomes per Archetype

Archetype	Description	Learning Outcomes
 Lead AI	Decides policy and doctrine, including how AI tools can or will be used; builds AI vision and plan	<ul style="list-style-type: none"> Determine how to deploy the responsible application of AI Articulate AI leadership vision and how it impacts their organization Recognize potential applications of AI use cases
 Drive AI	Ensures appropriate AI tools and capabilities are developed and delivered across DOD	<ul style="list-style-type: none"> Choose relevant cross-functional team members to develop AI tools Categorize & evaluate which ethical AI use cases best support Component strategy Demonstrate ability to identify, initiate, & lead AI projects
 Create AI	Creates AI tools to meet current and future needs	<ul style="list-style-type: none"> Develop & productionize a wide-array of ethical AI applications Determine which AI solution is most applicable to the use case Industrialize solutions to support enterprise-scale application
 Embed AI	Embedded with Employ AI, establishes AI systems and provides end-user support at tactical edge	<ul style="list-style-type: none"> Support use case development by solving down-range infrastructure constraints Analyze and aggregate data in preparation of ethical AI application development Adapt and solve AI application issues down-range to maintain functionality
 Facilitate AI	Represents users to ensure appropriate AI tools are developed and delivered to address use cases	<ul style="list-style-type: none"> Illustrate end-user needs and ensure they are built into the application Apply end-user needs to AI tool interface Analyze & simplify system outputs to support clear, ethical enterprise decision-making
 Employ AI	End-users of AI tools, provide feedback on and requirements for AI tools	<ul style="list-style-type: none"> Interpret AI application output to inform decision making Understand AI concepts and recognize potential future applications Demonstrate proficiency of engaging with and interpreting AI applications

5.3 Competencies

AI competencies are defined as the knowledge, skills, and abilities associated with AI (see Figure 5). However, competency requirements will vary by AI archetype, depending on the archetype-specific learning outcomes. Competencies are grouped into eight key topic areas.

Figure 5. AI Competencies

Competency Topic	Competencies
1 Foundational Concepts	<ul style="list-style-type: none"> Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack (to include Natural Language Processing, Natural Language Generation, Natural Language Understanding, Computer Vision, Neural Networks, Deep Learning, Computer Vision, Robotics, and Autonomous Operations) Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements successful application Advanced AI concepts: Understanding advanced and state-of-the-art AI methods
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none"> Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD (e.g., doctrine, warfighter displacement/dependence on machines, explainable AI, and trust)
3 Data Management and Visualization	<ul style="list-style-type: none"> Managing data: Understanding how to collect, store, and monitor data Visualizing data: Knowing how to structure and display data, as well as use data to create a story Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models
4 Responsible AI	<ul style="list-style-type: none"> Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations
5 Infrastructure, Coding, and Software Development	<ul style="list-style-type: none"> Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing Testing AI: Using models and prediction methods for evaluating AI performance DevSecOps: Understanding the tools and infrastructure needed to automate development, testing, securing, and deploying AI/ML-enabled software into the DoD AI frameworks: Understanding of the common frameworks used to implement AI methods
6 Mathematics, Statistics, and Data Science	<ul style="list-style-type: none"> Performing analysis: Applying mathematical and statistical analysis, (e.g. customized models / algorithms, predictive analytics) to understand and engage AI at technical level
7 AI Delivery	<ul style="list-style-type: none"> Managing product development: Understanding AI project management, including product development & prototyping Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy
8 AI Enablement	<ul style="list-style-type: none"> User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment Legal/IP Rights: Understanding of data rights, property rights, and intellectual property

¹⁵ Benjamin Bloom, *Taxonomy of educational objectives: The classification of educational goals*, 1956.

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Thus, each archetype will require a subset of AI competencies with varying levels of depth within competencies (see Figure 6). Competencies establish the foundation for recruiting, hiring, retention, and course curriculum requirements to ensure individuals within an archetype achieve the appropriate level of depth in content and focus on intended learning outcomes.

Figure 6. AI Competencies and Level of Topic Area Understanding¹⁶

		1 Foundational Concepts			2 AI Applications			3 Data Management & Visualization			4 Responsible AI		
		Understand AI	Apply AI	Advanced AI topics	ID trends	ID risks		Manage data	Visualize data	Data prep		Operate ethically	
	Lead AI	B	M		B	B		B				M	
	Drive AI	B	M	B	B	B		M	M	M		M	
	Create AI	M	M	A	B	B		A	M	A		A	
	Embed AI	M	M	M	B	B		A	M	A		B	
	Facilitate AI	B	M	B	M	M			B	B		M	
	Employ AI	B	B		B	B		B	B	B		B	
NDAA Sec. 256 topic		(C)			(H), (I), (G)			(A), (B), (E)			(F)		

		5 Infrastructure, Coding & Software Development						6 Math, Stats & Data Sci			7 AI Delivery			8 AI Enablement	
		Program & scripts	Software eng.	Operate in cloud	Computing	Testing AI	DevSecOps	AI framework	Perform analysis	Manage product dev.	Oversee AI delivery	Lead AI strategy	User-centric design	Legal/IP rights	
	Lead AI											M		B	
	Drive AI	M	M	B	M	M	B	B	B	B	M	M	B	A	
	Create AI	M	A	M	B	A	M	A	A	B	B		B	M	
	Embed AI	M	A	M	B	A		A	B	B	B	B	B	B	
	Facilitate AI	B				B		B		B	B	B	M	B	
	Employ AI												B		
NDAA Sec. 256 topic		(A), (B), (E)						(A), (B), (E)			(D)			(A)	

Curriculum depth: B Basic M Intermediate A Advanced

5.4 Curriculum Building Blocks

Based on archetype-specific competencies and level of topic area understanding (see Figure 6), a course curriculum is identified to align with learning outcomes. Curricula are determined based on the level of topic area understanding required for a given competency (see Figure 7). Figure 7 provides a guideline for relevant courses to satisfy given competencies, however the courses identified for each individual are based on that individual's base level of knowledge and concentration- or Component-specific requirements. The curriculum is intended to link all relevant DoD course offerings to meet the

¹⁶ Curriculum depth depicted is lowest common denominator for archetype

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competency requirements across AI archetypes. Then these courses, delivered through a mix of modalities and timeframes based on archetype-specific considerations, can meet the learning needs of individuals in particular roles. The level of topic understanding is described using a simplified version of the Dreyfus model of skill acquisition¹⁷:

- Basic correlates to Dreyfus’ *advanced beginner* as the student should be familiar with the domain and be able to perform tasks independently;
- Intermediate correlates to Dreyfus’ *competent* as the student should be able to perform common standard practices well along with mentoring basic users to become more competent when performing routine tasks;
- Advanced correlates to Dreyfus’ *proficient* as the student should have a high level of skill that others admire, imitate, and are trained on.

Figure 7. Curricula Based on Level of Topic Area Understanding and Competency

Competency Topic	Competencies	B Basic	M Intermediate	A Advanced
1 Foundational Concepts	Understand AI, Apply AI, Advanced AI topics	<ul style="list-style-type: none"> Intro to AI/ML concepts Key Terms Neural Networks & Deep Learning Supervised / Unsupervised Learning Autonomy Current AI uses in DoD Data in AI 	<ul style="list-style-type: none"> Computer vision AI Robotics Natural Language Processing Speech Recognition 	<ul style="list-style-type: none"> Military applications of AI Learning algorithms and training models
2 AI Applications	ID trends, ID risks	<ul style="list-style-type: none"> Future AI Uses in DoD Cyber Risks & Vulnerabilities Bias in AI 	<ul style="list-style-type: none"> Technical Future AI Uses in DoD Identifying Cyber Risks & Vulnerabilities 	<ul style="list-style-type: none"> Doctrine Explainable AI Trust
3 Data Management & Visualization	Manage, prep, and visualize data	<ul style="list-style-type: none"> Data-Driven Decisions & Culture 	<ul style="list-style-type: none"> Visualization Tools Data Preparation for ML 	<ul style="list-style-type: none"> Data Engineering & Orchestration Data Warehousing
4 Responsible AI	Operate ethically	<ul style="list-style-type: none"> Responsible AI Use throughout DOD (Intro) 	<ul style="list-style-type: none"> Responsible AI Use throughout DOD 	<ul style="list-style-type: none"> Technical Issues in Responsible AI (e.g., measuring bias & fairness)
5 Infrastructure, Coding, & Software Development	Program, SW eng., cloud, computing, testing, DevSecOps, AI frameworks	<ul style="list-style-type: none"> Intro to Programming and Languages Intro to DoD DevSecOps 	<ul style="list-style-type: none"> Programming and Languages 	<ul style="list-style-type: none"> Software Development Cloud Engineering Distributed Computing AI Infrastructure AI Computing Platforms
6 Mathematics, Statistics, & Data Science	Performing analysis	<ul style="list-style-type: none"> Data Analysis Elements of Data Science Intro to Algebra and Calculus Statistics & Probability 	<ul style="list-style-type: none"> Algebra and Calculus Statistics & Probability Data Analysis 	<ul style="list-style-type: none"> Analytic & Empirical Methods Algebra, Linear Algebra, Calculus Predictive Analysis Principal Component Analysis Machine Learning Theory
7 AI Delivery	Manage prod. dev, delivery, strategy	<ul style="list-style-type: none"> DevOps Agile & Innovative Leadership Analytical Thinking 	<ul style="list-style-type: none"> Product Management Structure of AI Delivery Military Strategy with AI Tech 	
8 AI Enablement	User centric design, legal/IP rights	<ul style="list-style-type: none"> Design Thinking Data Rights, Property Rights, & Intellectual Property 	<ul style="list-style-type: none"> UI/UX Design 	

Curriculum depth: **B** Basic **M** Intermediate **A** Advanced

5.5 Learning Journey

Learning outcomes, competencies, and curricula create learning journeys that are tailored to the needs of each archetype. Learning journeys take the curriculum of each archetype and layer in considerations around course content, complexity, and workforce size to determine the optimal mix of modalities and timeframe for each archetype. For example, the “Drive AI” archetype (see Figure 8) incorporates a mix of synchronous and asynchronous learning to accommodate the curriculum complexity and Competency requirements for that archetype.

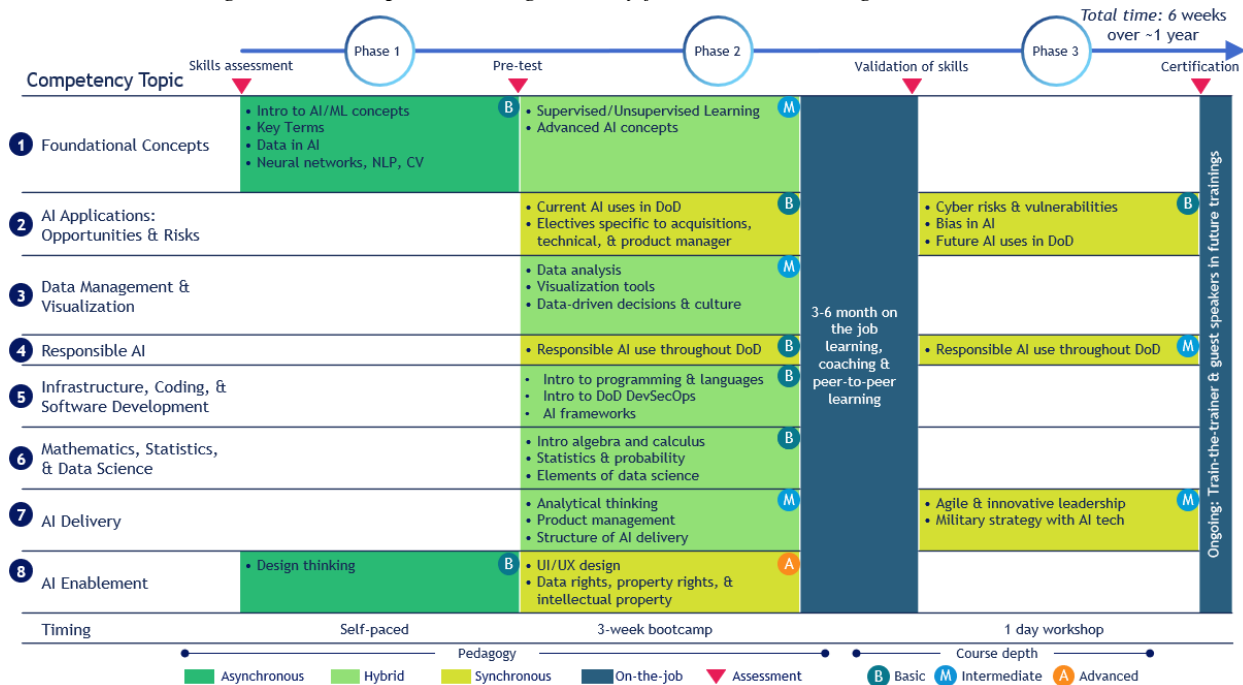
¹⁷ Hubert and Stuart Dreyfus, *Mind over Machine: the power of human intuition and expertise in the age of the computer*, 1986.

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The following guiding principles inform learning journeys to ensure successful learning, knowledge, and competency development:

- Modalities and pedagogies should be informed by best practices given learning outcomes and complexity but may be adjusted to allow implementation at DoD-scale.
- On-the-job training should be incorporated into all learning journeys to ensure use cases can be identified and skills can be applied.
- Assessment should be used across the learning journey to ensure measurement of program effectiveness against objectives, thereby allowing continuous program refinement and updates that address curriculum gaps and emergent skill needs.
- Pre-assessment and pre-work should be standardized to ensure all personnel in each archetype enter the program at a similar level.
- Common courses from commercial sources and academia should be used across learning journeys whenever possible to reduce content development, maintenance time, and cost.

Figure 8. Example Learning Journey for Product Managers: “Drive AI”



The archetype-specific learning journeys establish a set of consolidated learning programs that are tailored to different needs across the DoD workforce, while enabling a scalable AI learning program. Success of such programming, however, depends upon an organizational infrastructure that facilitates AI education and training.

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6 Governance

Given the coordination, culture, and change management challenges DoD faces with respect to large-scale education and training transformation, centralized management is critical to coordinating, tracking, and enabling AI awareness, education, and training efforts. Although funding and execution of the majority of AI education and training programming will occur within the Components, a central AI awareness, education and training function will facilitate cross-Component coordination, consolidate and invest in common requirements, and measure and monitor the overall AI learning program. The JAIC, given its role as the focal point for the DoD AI Strategy, is best positioned to assume the central management role for AI education development and oversight.

Specifically, DoD anticipates complementary roles between the JAIC and the Components:

Role of the JAIC: *Deliver AI awareness, education, training, and certification as a service and provide common foundations.*

- Develop, maintain, and update high level learning journeys regularly based on emerging needs.
- Create common curricula (e.g., Responsible AI for DoD, AI 101 for Employ) and host on a central platform.
- Fund and execute learning journey pilots to test elements of the overall program.
- Deliver “Lead AI”, “Drive AI”, “Create AI”, and “Facilitate AI” learning programs.
- Identify and manage concentration-specific industry certification standards and assessments to ensure skills remain current.
- Provide realistic training that simulates actual DoD environments (e.g., JCF).
- Establish and manage DoD instructors and commercial contracts with preferred AI education and training vendors that can be seamlessly accessed by Components.
- Aggregate and disseminate best practices and lessons learned from industry, archetype pilots, and across the DoD.
- Measure effectiveness of the program (to include each Component’s “Embed AI” and “Employ AI” learning programs) and identify gaps across DoD.
- Report on the implementation and approach of the Department’s AI training to the Office of the Secretary of Defense (OSD) and the Office of the Undersecretary of Defense for Personnel and Readiness (P&R).
- Maintain and update the DoD *AI Education Strategy*.

Role of Components: *Manage AI talent and inform requirements for awareness, education, and training.*

- Establish AI workforce size requirements as part of the total force planning process, including the make versus buy balance.

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- Define AI workforce strategy to inform human capital and education strategies.
- Identify individuals who should participate in pilot learning programs (e.g., summer '21 JAIC-inbound cohort).
- Organize, train, and equip AI talent and send through DoD-delivered learning programs.
- Supplement central learning efforts with Component-specific requirements.
- Deliver “Embed AI” and “Employ AI” learning programs.
- Execute workforce assessment to map specific individuals into the workforce framework.
- Adapt and incorporate AI curricula into existing workforce learning efforts.
- Identify and leverage resources and contribute feedback to central platform to bolster and scale program.

7 Implementation Plan

7.1 Lines of Effort

Implementation for the *AI Education Strategy* prioritizes AI delivery and scales with demand. The complexities associated with delivering a learning program across Components, military and civilians alike, and across all levels of leadership are widely acknowledged, and will be addressed across four main lines of effort: 1) Phasing and prioritization, 2) Coordination and funding, 3) Planning and tracking, and 4) Refinement.

Phasing and prioritization. Recognizing the immense scale of upskilling the entire DoD workforce, AI instruction will be prioritized and scaled over time to ensure feasible execution and responsible use of taxpayer dollars. The *AI Education Strategy* will prioritize learning for the “Lead AI” archetype and concentrations that make up IPTs early during implementation. Training and education for other archetypes will be scaled ahead of Component-defined demand. This approach will phase financial and manpower costs over time while ensuring adequate AI applications are available for program participants to apply their new skills.

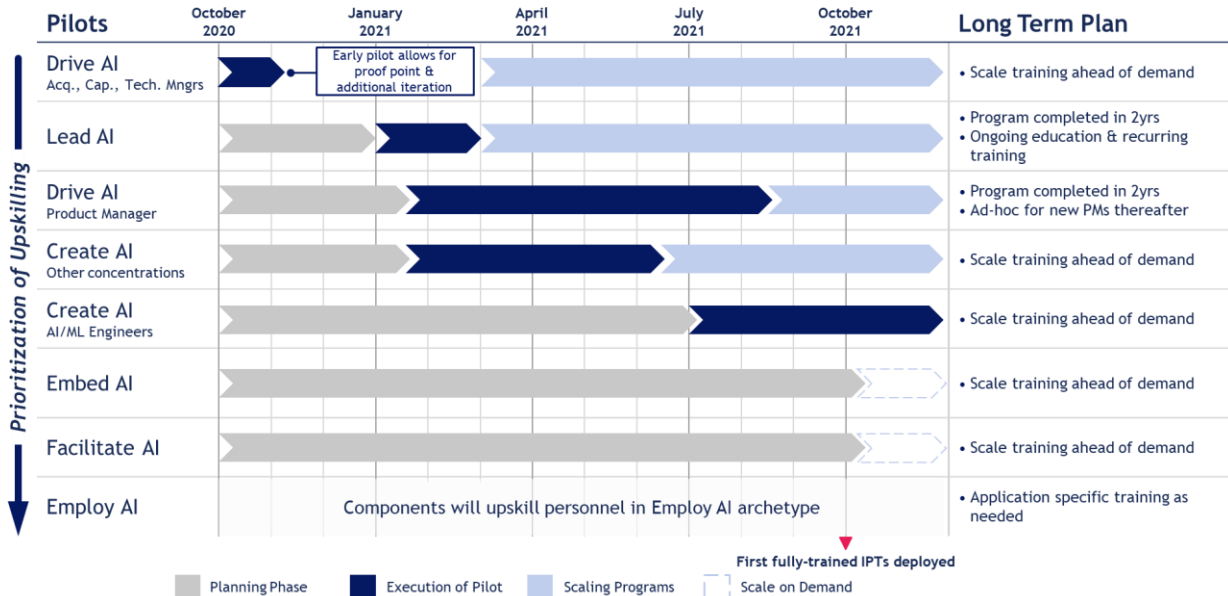
DoD will use an iterative, agile-like methodology for AI learning given the rapidly evolving nature of AI technology and applications. This pilot, test, iterate, and scale approach will enable DoD to hypothesize, test, learn, and improve rapidly prior to large-scale deployment and investment. Fiscal Year 2021 (FY21) efforts will activate the AI learning journey with pilots of each of the prioritized concentrations (see Figure 9). The pilot programs will be executed with the following objectives:

- Gather lessons learned to inform future program design and maximize effectiveness (e.g., test learning approaches, modalities, digital platforms).
- Refine understanding of capabilities and resources required to support enterprise-wide learning programs (e.g., platform, budget, coaching).

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- Increase the awareness and knowledge of the first cohort of senior leaders and IPTs, creating a value proof to build momentum for scale.

Figure 9. Concentration-Specific Prioritization for AI Education Program Pilots



Fiscal Year 2022 (FY22) and beyond efforts will shift from piloting to scaling. The concentration-specific pace of scale will be set based on Component-defined workforce requirements. Workforce planning and management will be important to ensure the program is scaled just ahead of demand. “Lead AI”, “Drive AI”, “Create AI”, and “Facilitate AI” learning programs will be centrally designed and executed to reduce duplication and achieve economies of scale. Components may choose to supplement these centralized programs with additional training and education for Component-specific requirements. Ongoing learning programs in the Components should continue, but over time, learning efforts for these archetypes will converge towards the centralized solutions. The learning programs of the last two archetypes, “Embed AI” and “Employ AI”, will vary significantly between Components according to different AI use cases. The Components will design the learning programs for decentralized execution ahead of the adoption of new AI technology, supported by centralized resources on program design, upskilling, best practices, and basic AI training modules.

Coordination and funding. Ensuring cost-effective implementation at DoD-scale means avoiding redundancy, leveraging economies of scale, and building common solutions whenever possible. The JAIC will conduct four key activities in service of this objective:

- Develop and host a central platform to gather and disseminate best practices, identify specific best-in class implementations as course content, and allow real-time access to remote learning content (e.g., AI 101 web-based).
- Identify existing DoD contracts with preferred vendors that take advantage of at-scale purchasing to establish preferred rates while making Component acquisitions simpler and faster, and establish additional contracts as required. This also avoids duplicative purchasing of similar requirements with different vendors across the Components.

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- Centrally maintain and host common curriculum and learning journeys. Update regularly based on emerging needs (e.g., new technology developments), assessments of learning effectiveness, and feedback from participants and Components. Content will be sourced exclusively from industry, except for DoD-unique requirements (e.g., Responsible use of AI in defense). This will ensure that AI education and training focuses on the latest technological developments without burdening DoD with maintaining a large cohort of education and learning professionals devoted to content creation and maintenance.
- Implementing a workforce learning program at this scale will require significant resources. Funding has already been committed to ongoing AI research and development. These investments must continue, and additional investments are necessary to accelerate DoD's ability to deliver AI capabilities. In coordination with the Components, the JAIC will determine funding requirements for the *AI Education Strategy* over the Future Years Defense Program (FYDP) based on anticipated workforce requirements and costs refined throughout the pilot phase. Funding requirements include centralized funding of common education and training programs as well as funding for Component-specific requirements and Component-led delivery of "Embed AI" and "Employ AI" archetype learning programs.

Planning and tracking. Due to the complexity and importance of an AI-ready force, the JAIC will also develop AI talent certifications, assessments, and participant tracking in order to standardize the key skills across the Department. The JAIC will conduct four key activities in service of this objective:

- Identify industry standards and certifications that apply to each archetype. As with training content itself, use of industry standards will allow the DoD to change with industry seamlessly rather than trying to keep pace separately.
- Develop AI skills assessments that Components can use to map individuals into archetypes and establish baseline skill levels.
- Identify or establish cross-DoD mechanisms for tracking AI awareness, knowledge, and skills in close collaboration with other DoD digital workforce efforts. A key implementation consideration will be an approach that aligns disparate personnel systems across Components to reduce implementation time and to minimize cost.
- Develop an approach and mechanism for Components to nominate individuals for centralized AI learning program. Initial FY21 pilot programs will be limited in scale to allow for an informal process. As the program begins to scale in FY22 and beyond, a formalized approach will be needed to streamline the process and reduce the burden on the Components' budgets.

Refinement. Due to the speed at which AI technology is evolving, the *AI Education Strategy* will need to evolve with it. The JAIC will be responsible for piloting initial training, refining learning journeys, and periodically updating the *AI Education Strategy* based on lessons learned, education outcomes, and input from participants and Components. Additionally, the JAIC will ensure the *DoD AI Education Strategy* evolves with the broader strategic context and *DoD AI Strategy*.

7.2 Key Performance Indicators

Using industry best practices for digital upskilling programs, DoD identified Key Performance Indicators (KPIs) (see Figure 10) to evaluate the AI learning program success and course correct as needed. KPIs

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include both measures for scale and effectiveness of programming in building competency levels across the Department. These metrics will be reported within the Department by the JAIC to ensure DoD leadership is aware of progress.

Figure 10. KPIs

Category	What they measure	KPIs
Value Delivery	<ul style="list-style-type: none"> Is the program resulting in delivery and adoption of AI use cases across DoD? 	Number of delivered AI use cases Number of Components that have delivered AI use cases Utilization (%) of program “graduates” who are in roles involving AI
Program Adoption	<ul style="list-style-type: none"> Is the program being used by the Components? 	Number of personnel who have enrolled in program Number of personnel who have completed the program Number of Components with personnel who have completed the program Number of personnel who have enrolled in program compared to Component targets ¹⁸ Number of personnel who have completed the program compared to Component targets
Program Effectiveness	<ul style="list-style-type: none"> Is the program effective in delivering AI competencies? 	Participant performance on program assessments (pre- and post-program) Participant self-reported satisfaction with learning program Component satisfaction with learning program Cost to train a participant

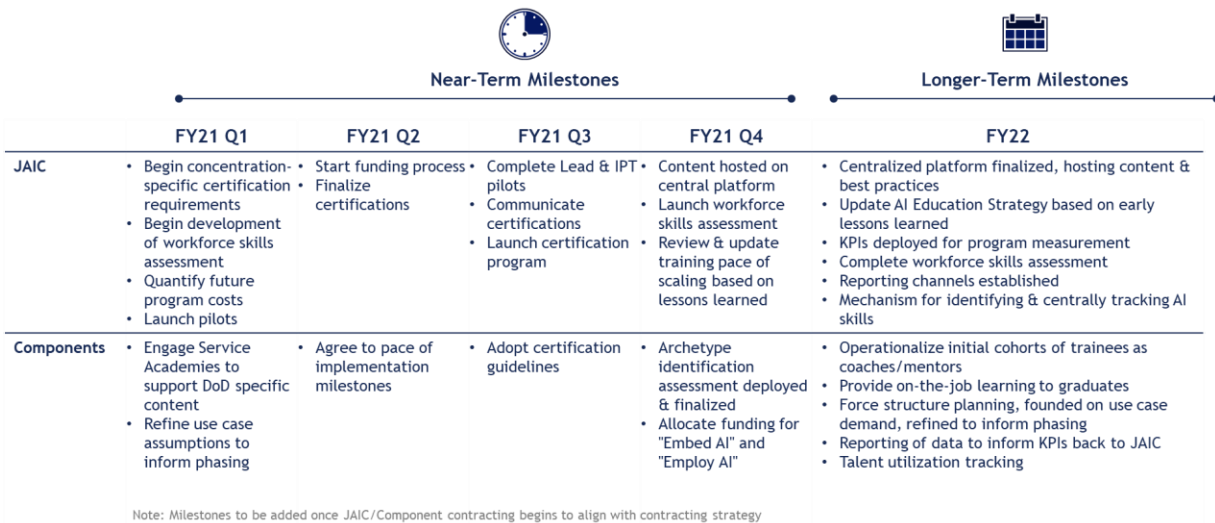
¹⁸ Targets will be based off use case demand

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7.3 Milestone Schedule

The JAIC, in coordination with the Components, will establish and maintain a milestone schedule (see Figure 11). The milestones will allow JAIC and the broader DoD to assess program progress, identify deviations, and react swiftly to address risks and keep progress on track.

Figure 11. Key Milestones



8 Summary

Advancements in commercial technology are changing the global national security landscape, and the DoD is collaborating with industry to ensure our defense capabilities take advantage of changing technological innovation. Technology alone, however, will not secure the United States military advantage. Technological adoption within the DoD depends on the organizational culture and competencies that enable the ready force to leverage and accelerate technological advancements. Large-scale AI culture and competency development requires targeted upskilling across the entire DoD workforce to unlock the potential of those who will carry the Department forward into the Digital Age. Establishing an overarching *AI Education Strategy* for the DoD workforce is a pivotal step toward ensuring the U.S. remains ready to fight.

9 Appendix A: Methodology and Organizations Consulted

The strategy and implementation plan synthesize best practices in learning and education, benchmarking of industry and government digital competency development, and expert interviews with best-in-class industry leaders in digital upskilling. In addition, research and leader interviews were conducted on related DoD AI and digital training programs to gather DoD-specific best practices and lessons learned as well as identify opportunities for re-use, coordination, and collaboration. Throughout the development of the strategy and implementation plan, the JAIC-led DoD Artificial Intelligence Workforce Subcommittee reviewed draft materials to ensure their feedback was incorporated throughout the process.

The following organizations were consulted in the development of the *AI Education Strategy* and implementation plan, either via their participation in the AI Workforce Subcommittee, expert interviews, or both:

Air Force ISR	Navy NAVSEA
Air Force A2/6	Navy NIWC
Air Force CSAF Strategic Studies Group	Navy NUWC
Air Force A9	Navy NAVAIR
Air Force A5	Navy SPAWAR
Army Talent Management TF	Navy CNO
Army Futures Command	Navy DCNO N1
Army Artificial Intelligence Task Force	Navy DCNO N7
Army DCS G-1	Navy NPS
Army CCDC	Navy CIO
Army MEDCOM	NSA DSAW
Army ASA M&RA; People Analytics	National Security Commission on AI
Army HQDA G-1	OUSD CIO
Army Research Laboratory	OUSD, I&S
Army Office of the Surgeon General	OUSD, P&R
OSD Cost Analysis and Program Evaluation (CAPE)	OUSD, R&E
CJCS JS J1	OUSD, A&S
CJCS JS J4	OUSD, C
CJCS JS J6	SOCOM
CJCS JS J7	USMC Intelligence
CJCS JS J8	USCG ORDAWG
Office of the Chief Management Officer	USCG C5I
DCSA CDSE	USMC DCI War Room
DDS	

10 Appendix B: Lead AI Worker Archetype

10.1.1 Archetype

As a Senior Executive or General Officer, this person leads the DoD's adoption, use, and future plans of AI-enabled technology. This person, while not an AI expert, sets a clear path and expectations for the usage of AI tools to build a data-driven culture and ensure mission success.

Key responsibilities include:

- Be inspired by AI and able to inspire the organization
- Build and maintain an AI vision and strategic plan
- Understand how to utilize staff with AI expertise effectively

10.1.2 Archetype Concentrations

Even within the “Lead AI” archetype, not all individuals will have the same education and training needs. The “Lead AI” archetype clearly defines concentrations that are reflective of roles across the Components. These concentrations ensure the “Lead AI” learning journey accounts for meaningful differentiation between each group. While the skillset requirements will be similar across concentrations, the application of those skillsets may vary; therefore, archetype concentrations allow for specialization within learning journeys.

Lead AI Concentration	Role description	Example MIL/CIV careers	Key differentiations in AI use
Policy	Create and write overarching guidance on AI use throughout DoD	OSD PSAs	<ul style="list-style-type: none"> • Plan for and guide future use cases of AI • Evolve strategy, doctrine, policy to account for use of AI
Command	Ensure AI policy is carried out by personnel they lead; make decisions that support AI use	CENTCOM CO	<ul style="list-style-type: none"> • Understand / internalize OSD guidance on AI • Lead the implementation of AI use throughout DoD
Agency / Function Lead	Ensure AI policy carried out in non-Combat roles	Director, Defense Health Agency	<ul style="list-style-type: none"> • Support to DoD combat organizations • Ensure use of AI to increase efficiency and effectiveness of operations

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10.1.3 Workforce Sizing

Preliminary workforce sizing estimates are included as an order of magnitude estimate only. They are not intended to provide a definitive view of the size of the DoD workforce in each concentration. Instead, they are meant to provide insight into the potential scale of the required learning program and are used to inform the modalities through which the “Lead AI” curriculum is delivered as well as its implementation. Values represent the number of individuals that either currently fulfill the requirements of the archetype or have the potential to be upskilled with the archetype.

Concentration	# MIL (K) 2017 ¹⁹	# CIV (K) 2017
Policy, Command, Agency/Function Lead	Very Small	Small

10.2 Learning Outcomes

At the conclusion of the AI education and training program, the “Lead AI” archetype should be able to achieve the following learning outcomes:

- Determine how to deploy the ethical application of AI
- Articulate AI leadership vision and how it impacts the organization
- Recognize potential application of AI use cases

¹⁹ Very small is less than 1,000; small is 1,000-10,000; medium is 10,000-20,000; large is 20,000-100,000; very large is 100,000+

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10.3 Competencies

Competencies are a catch-all term for the knowledge, skills, abilities, and other attributes expected of each archetype. AI competencies were developed using existing AI/digital workforce efforts of DoD and the commercial sector. Competencies provide guidance that is specific, yet flexible enough to accommodate a rapidly evolving talent market and Component-specific requirements.

Figure 12. Lead AI: Relevant Competencies and Associated Curriculum²⁰

Competency Topic	Competencies	Curriculum
1 Foundational Concepts	• Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack	B
	• Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements for the successful delivery of AI tools	M
	• Advanced AI concepts: Understanding advanced and state-of-the-art AI methods	
2 AI Applications: Opportunities and Risks	• Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research	B
	• Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD	B
3 Data Management & Visualization	• Managing data: Understanding how to collect, store, and monitor data	B
	• Visualizing data: Knowing how to structure and display data, as well as use data to create a story	
	• Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models	
4 Responsible AI	• Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations	M
5 Infrastructure, Coding, and Software Development	• Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL	
	• Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models	
	• Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools	
	• Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing	
	• Testing AI: Using models and prediction methods for evaluating AI performance	
	• DevSecOps: Understanding how to automate development, testing, securing, and deploying AI/ML-enabled software to the DoD	
6 Mathematics, Statistics, and Data Science	• AI frameworks: Understanding of the common frameworks used to implement AI methods	
7 AI Delivery	• Performing analysis: Applying mathematical tools, (e.g. customized models / algorithms, predictive analytics) for AI tool dev	
	• Managing product development: Understanding AI project management, including product development & prototyping	
	• Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users	
8 AI Enablement	• Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy	M
	• User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment	
	• Legal/IP Rights: Understanding of data rights, property rights, and intellectual property	B

Curriculum depth: B Basic M Intermediate A Advanced

²⁰ Competencies without an assigned curriculum depth were deliberately left blank as they are not a part of this archetype's learning journey.

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10.4 Curriculum Building Blocks

Within each concentration, there is a minimum set of knowledge, skills, and abilities to address the future AI competencies needed within DoD. These competencies are organized into a curriculum to provide a guideline of coursework that satisfies FY20 NDAA Sec. 256 curriculum requirements. The suggested curriculum is intended to guide Components' AI education paths, not stifle existing initiatives. This curriculum represented at a high level below articulates the minimum requirement for each concentration. There can be a technical and non-technical journey dependent on each concentration's needs.

	Applicable to all concentrations	Policy	Command	Agency / Function Lead
1 Foundational Concepts	<ul style="list-style-type: none"> Understand basic AI concepts and terminology Create AI strategy and communicate it to technical and non-technical audiences Role model "Agile" ways of working as a senior leader 	<ul style="list-style-type: none"> Understand best practice AI use cases, roles, and operating models in industry Engage commands, when appropriate, to support AI initiatives 	<ul style="list-style-type: none"> Leverage core AI concepts and trends to develop command-level AI strategy Communicate foundational concepts and AI strategy to command 	
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none"> Understand application and use cases for AI Support development of AI best practices, including AI roles, use case identification, operating models Track developments in AI that could shape use cases and organizational priorities 	<ul style="list-style-type: none"> Understand how emerging trends in AI tech will impact use cases for DoD 	<ul style="list-style-type: none"> Share best practices and innovations across commands Understand how to leverage AI roles and talent for effective use of applications 	<ul style="list-style-type: none"> Understand how to leverage AI roles and talent for effective use of applications
3 Data Management and Visualization			<ul style="list-style-type: none"> Enable appropriate data hygiene, collection and management to support AI tools 	<ul style="list-style-type: none"> Enable appropriate data hygiene, collection and management to support AI tools
4 Responsible AI	<ul style="list-style-type: none"> Clear perspective on ethical governance of AI Understand ethical application of AI-enabled tools Awareness of ethical risks associated with particular use cases 	<ul style="list-style-type: none"> Establishing guidelines for acceptable risk tolerance in employing/adopting AI into DoD missions and processes Contribute to development of principles, policies and governance that manages deployment of AI in DoD 	<ul style="list-style-type: none"> Adapt ethical and safety principles for Command, while effectively communicating them downward 	<ul style="list-style-type: none"> Practice stewardship over initiatives that address emerging AI trends and use cases
7 AI Delivery	<ul style="list-style-type: none"> Understand integration of AI systems into ways of working Knowledge of AI-enabled changes in operating model 	<ul style="list-style-type: none"> Support delivery of AI systems to end users that is consistent with DoD AI digital policy and strategy Ensure feedback loops established for iterative approach 		<ul style="list-style-type: none"> Support AI via digital-friendly governance
8 AI Enablement	<ul style="list-style-type: none"> Understand legal and intellectual property considerations with respect to AI capabilities 			

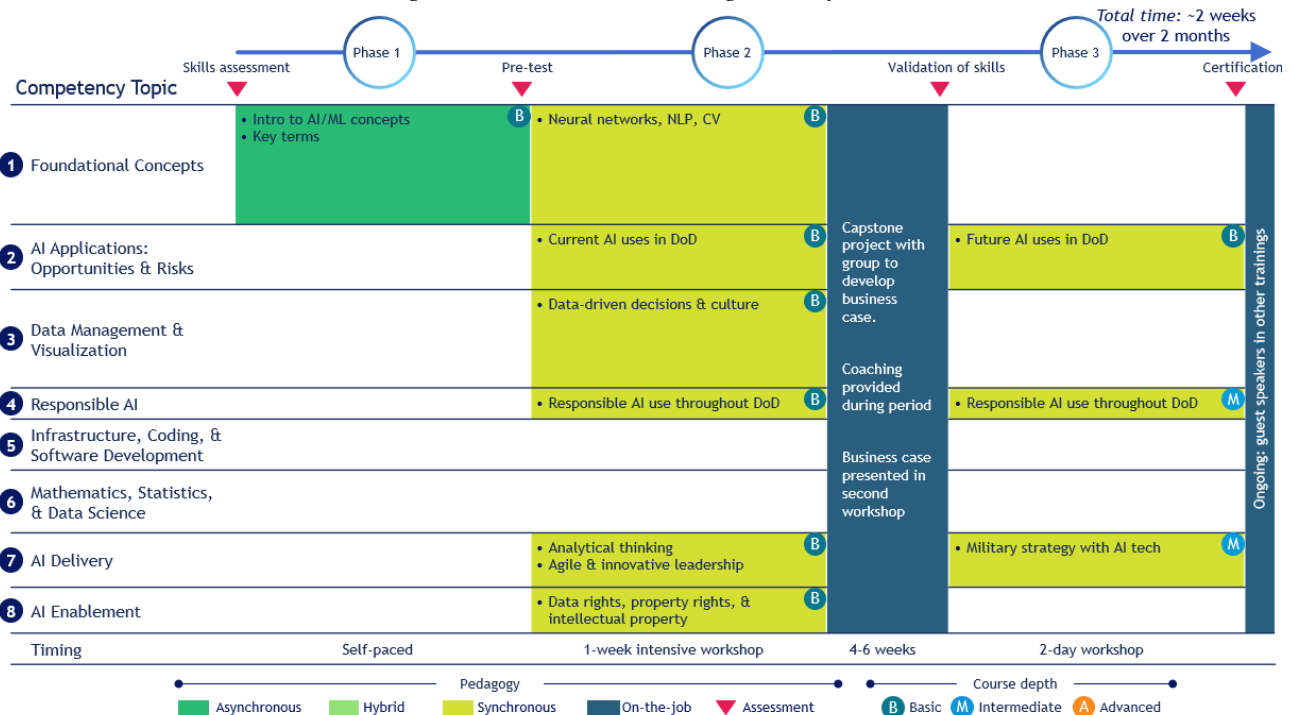
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10.5 Learning Journey

The learning journey leverages commercial efforts and adult learning best practices to provide guidance on curriculum design, content, and delivery. It is intended to serve as guidance to the Components and repurposed to fit their specific context. The learning journey is not meant to be a one-size-fits-all approach to AI education and is not a prescriptive implementation plan.

The learning journey outlines how the “Lead AI” curriculum will be delivered across time and modality to address the archetype specific competency requirements and meet the defined learning outcomes. Given the competency requirements for “Lead AI”, a blended approach to curriculum delivery is recommended:

Figure 13. Lead AI: Learning Journey



11 Appendix C: Drive AI Worker Archetype

11.1 Workforce Framework

11.1.1 Archetype

As a manager of AI personnel and AI-enabled tool development, this person drives the DoD forward in its usage of AI technology. They ensure appropriate AI tools and capabilities are developed and delivered across DOD. Through cross-DoD and vendor engagement, this person fulfills AI requirements through internal development or external acquisition means. This person must be proficient in AI technology in order to manage AI delivery teams skillfully.

Key responsibilities include:

- Understanding trends and likely future use cases of AI
- Prioritizing AI use cases and investments
- Managing AI talent to deliver AI tools that address requirements

11.1.2 Archetype Concentrations

Even within the “Drive AI” archetype, not all individuals will have the same education and training needs. The “Drive AI” archetype clearly defines concentrations that are reflective of roles across the Components. These concentrations ensure the “Drive AI” learning journey accounts for meaningful differentiation between each group. While the skillset requirements will be similar across concentrations, the application of those skillsets may vary; therefore, archetype concentrations allow for specialization within learning journeys.

Drive AI Concentration	Role description	Example MIL specialties	Example CIV careers	Key differentiations in AI use
Acquisitions Manager	Access technology/capabilities through contracting	Acquisition managers: Army 51C, Air Force 63A, USMC 8059	Program Manager, Contracting officer	<ul style="list-style-type: none"> • Recognizes AI technology, talent available in industry • Understands AI-specific acquisition models (e.g., pay per use or per data element)
Capability Manager	Evaluate and develop force structure resources and requirements	Human Resource Manager: Army: 42A USMC 0102	J5 (Strategy & Policy), J8 (Force Structure)	<ul style="list-style-type: none"> • Understand roles that require AI knowledge and skills • Project and manage growth of AI roles
Technical Manager	Defines the tech strategy across a project portfolio	Scientist, engineering: Air Force: 43B Army: 140E USMC: 5970	Computer/nuclear engineer, Operations research	<ul style="list-style-type: none"> • Leads technical approach across a portfolio of tools • Assesses technical risks and opportunities
Product Manager	Ensures the creation of AI-enabled tools	Development Engineer: Air Force: 62E	Product Manager, J6	<ul style="list-style-type: none"> • Understands how AI can deliver user-centric solutions • Manages creation of AI tools that will address requirements

DoD AI Education Strategy

11.1.3 Workforce Sizing

Preliminary workforce sizing estimates are included as an order of magnitude estimate only. They are not intended to provide a definitive view of the size of the DoD workforce in each concentration. Instead, they are meant to provide insight into the potential scale of the required learning program and are used to inform the modalities through which the “Drive AI” curriculum is delivered as well as its implementation. Values represent the number of individuals that either currently fulfill the requirements of the archetype or have the potential to be upskilled with the archetype.

Concentration	# MIL (K) 2017 ²¹	# CIV (K) 2017
Acquisitions Manager	Small	Large
Capability Manager	Small	Medium
Technical Manager	Small	Medium
Product Manager	Small	Small

11.2 Learning Outcomes

At the conclusion of the AI education and training program, the “Drive AI” archetype should be able to achieve the following Learning Outcomes:

- Choose relevant cross-functional team members to develop AI tools
- Categorize and evaluate which ethical AI use cases best support Component strategy
- Demonstrate ability to identify, initiate, and lead AI project

²¹ Very small is less than 1,000; small is 1,000-10,000; medium is 10,000-20,000; large is 20,000-100,000; very large is 100,000+

DoD AI Education Strategy

11.3 Competencies

Competencies are a catch-all term for the knowledge, skills, abilities, and other attributes expected of each archetype. AI competencies were developed using existing AI/digital workforce efforts of DoD and the commercial sector. Competencies provide guidance that is specific, yet flexible enough to accommodate a rapidly evolving talent market and Component-specific requirements.

Figure 14. Drive AI: Relevant Competencies and Associated Curriculum

Competency Topic	Competencies	Curriculum
1 Foundational Concepts	• Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack	B
	• Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements for the successful delivery of AI tools	M
	• Advanced AI concepts: Understanding advanced and state-of-the-art AI methods	B
2 AI Applications: Opportunities and Risks	• Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research	B
	• Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD	B
3 Data Management & Visualization	• Managing data: Understanding how to collect, store, and monitor data	M
	• Visualizing data: Knowing how to structure and display data, as well as use data to create a story	M
	• Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models	M
4 Responsible AI	• Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations	M
	• Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL	M
5 Infrastructure, Coding, and Software Development	• Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models	M
	• Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools	B
	• Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing	M
	• Testing AI: Using models and prediction methods for evaluating AI performance	M
	• DevSecOps: Understanding how to automate development, testing, securing, and deploying AI/ML-enabled software to the DoD	B
	• AI frameworks: Understanding of the common frameworks used to implement AI methods	B
6 Mathematics, Statistics, and Data Science	• Performing analysis: Applying mathematical tools, (e.g. customized models / algorithms, predictive analytics) for AI tool dev	B
7 AI Delivery	• Managing product development: Understanding AI project management, including product development & prototyping	B
	• Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users	M
	• Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy	M
8 AI Enablement	• User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment	B
	• Legal/IP Rights: Understanding of data rights, property rights, and intellectual property	A

Curriculum depth: B Basic M Intermediate A Advanced

DoD AI Education Strategy

11.4 Curriculum Building Blocks

Within each concentration, there is a minimum set of knowledge, skills, and abilities to address the future AI competencies needed within DoD. These competencies are organized into a curriculum to provide a guideline of coursework that satisfies FY20 NDAA Sec. 256 curriculum requirements. The suggested curriculum is intended to guide Components' AI education paths, not stifle existing initiatives. Minimum requirements for each concentration are represented at a high level below, which inform the curriculum for each concentration. There can be a technical and non-technical journey dependent on each concentration's needs.

	Applicable to all concentrations	Acquisitions Manager	Capability Manager	Technical Manager	Product Manager
1 Foundational Concepts	<ul style="list-style-type: none"> Understand AI/ML concepts, including key terms Comprehend overarching AI strategy 	<ul style="list-style-type: none"> Recognize AI operating model's technical needs Acquire needed AI tech and/or capabilities Define AI solution requirements 	<ul style="list-style-type: none"> Understand AI roles and emerging trends in AI/ML Evaluate AI roles needed for strategy execution Hire for AI roles and allocate resources as necessary 		<ul style="list-style-type: none"> Understand how AI can be developed to apply to specific use cases
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none"> Understand relevant AI applications Awareness of opportunities and risks based on emerging AI trends 	<ul style="list-style-type: none"> Understand AI providers / developers and how to evaluate AI solutions Evaluate vendors' AI solutions 	<ul style="list-style-type: none"> Ensure alignment of roles with individual AI applications for maximum impact 	<ul style="list-style-type: none"> Understand technical challenges, risks, and opportunities associated with individual application 	
3 Data Management and Visualization	<ul style="list-style-type: none"> Interpret output of AI tools and make data-driven decisions 			<ul style="list-style-type: none"> Interpret output of AI tools to evaluate performance 	
4 Responsible AI	<ul style="list-style-type: none"> Understand ethical risks associated with AI Understand potential biases or limitations of individual AI systems 			<ul style="list-style-type: none"> Understand technical risks in AI system that impact safety 	<ul style="list-style-type: none"> Understand ethical risks and mitigation strategies for individual products
5 Infrastructure, Coding, and Software Development				<ul style="list-style-type: none"> Understand AI development best practices Recognize problems in data management or software engineering 	<ul style="list-style-type: none"> Capable of defining solutions to technical challenges and coordinating implementation with developer talent
6 Mathematics, Statistics, and Data Science					<ul style="list-style-type: none"> Validate and evaluate effectiveness of AI tools, predictive models produced by Create team
7 AI Delivery		<ul style="list-style-type: none"> Coordinate technology that will enable effective delivery of AI solutions 		<ul style="list-style-type: none"> Define digital strategy for specific AI use cases Oversee product development of AI tools Collaborate to solve AI implementation issues Lead prototyping and experimentation in development teams 	<ul style="list-style-type: none"> Lead an agile team that can iterate, integrate end user feedback and prototype quickly
8 AI Enablement	<ul style="list-style-type: none"> Understand legal and intellectual property considerations with respect to AI capabilities 		<ul style="list-style-type: none"> Ensure roles defined and resourced for engaging in design of systems (e.g. UX) 	<ul style="list-style-type: none"> Understand key design choices that will impact system use and adoption rate 	<ul style="list-style-type: none"> Integrate end user perspective into design choices to maximize adoption and usability

DoD AI Education Strategy

11.5 Learning Journey

The learning journey leverages commercial efforts and adult learning best practices to provide guidance on curriculum design, content, and delivery. It is intended to serve as guidance to the Components and repurposed to fit their specific context. The learning journey is not meant to be a one-size-fits-all approach to AI education and is not a prescriptive implementation plan.

The learning journey outlines how the “Drive AI” curriculum will be delivered across time and modality to address the archetype specific competency requirements and meet the defined learning outcomes. Given the competency requirements for “Drive AI”, a blended approach to curriculum delivery is recommended:

Figure 15. Drive AI: Learning Journey for Product Managers

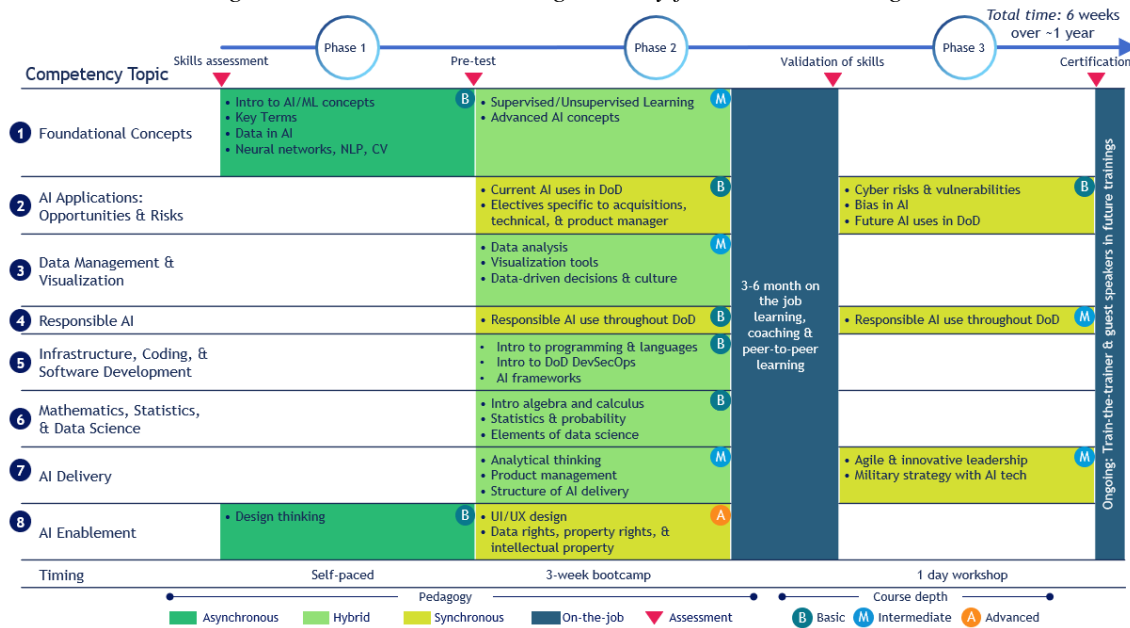
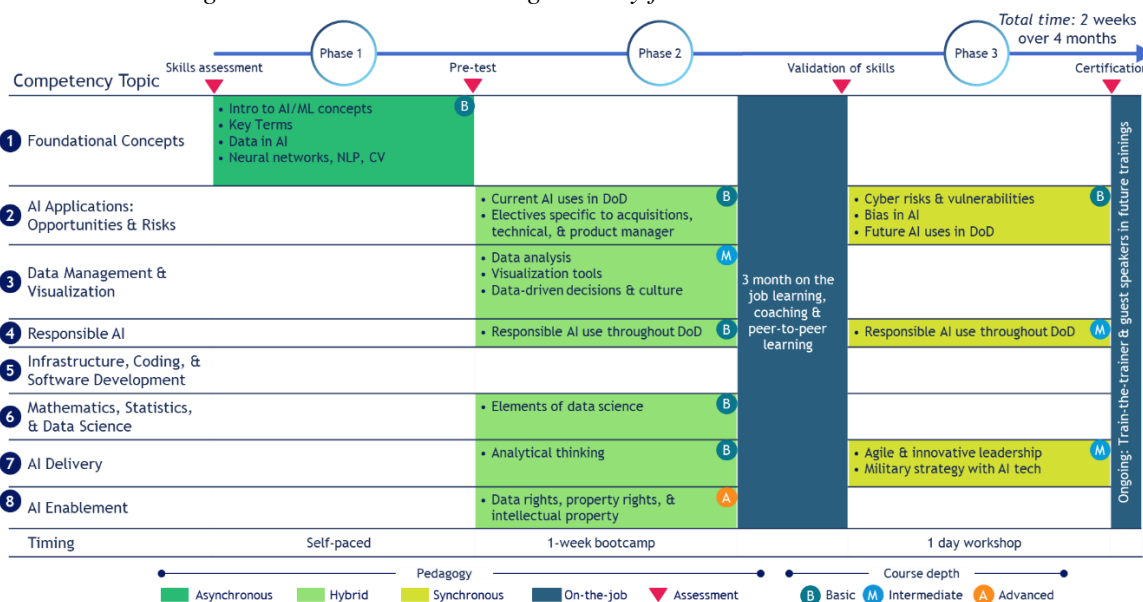


Figure 16. Drive AI: Learning Journey for All Other Concentrations



12 Appendix D: Create AI Worker Archetype

12.1 Workforce Framework

12.1.1 Archetype

As a technical expert, this person will be part of the process to deliver AI-enabled tools to end users. This person must understand the requirements, abilities, and potential barriers end users may have in deploying tools and have the technical proficiency to build and deploy solutions.

Key responsibilities include:

- Proficient in AI and big data tools (e.g., Python, Spark, AWS)
- Continue to advance technical skills; stay up-to-date with AI advancing technology

12.1.2 Archetype Concentrations

Even within the “Create AI” archetype, not all individuals will have the same education and training needs. The “Create AI” archetype clearly defines concentrations that are reflective of roles across the Components. These concentrations ensure the “Create AI” learning journey accounts for meaningful differentiation between each group. While the skillset requirements will be similar across concentrations, the application of those skillsets may vary; therefore, archetype concentrations allow for specialization within learning journeys.

Create AI Concentration	Role description	Example MIL specialties	Example CIV careers	Key differentiations in AI use
AI Researcher	Overall AI expert; pushes DoD AI capability forward by predicting and preparing for future use cases; innovator of AI tools	Air Force Intelligence: 14N Computer Systems Programmer: 3D0X4 Physicist/ Nuclear Engineer: 61D	DARPA Artificial Intelligence Research Associate	<ul style="list-style-type: none"> • Expert in AI technology and research • Develops new foundational AI techniques and applications
AI/Machine Learning (ML) Engineer	Build, test, integrate, and deploy AI tools; expert at coding and programming	N/A	AI Assurance Engineer	<ul style="list-style-type: none"> • Creator of AI tools • Understanding of how AI tools will be used
Test & Evaluation Engineer	Evaluate system capabilities and limitations; identify operational risks	Air Force 2A, 12E Army 94H	Test & Evaluation Engineer, System Engineer	<ul style="list-style-type: none"> • Understand and identify AI failure modes • Characterize performance within and outside operational parameters

DoD AI Education Strategy

Create AI Concentration	Role description	Example MIL specialties	Example CIV careers	Key differentiations in AI use
Data Scientist	Apply AI tools to perform analytics and create use case-specific solutions	Air Force Intelligence : 14N ORSA : 15A Network Analyst: 1N4 Army: 35T	Operations Research Analyst	<ul style="list-style-type: none"> Expert applying AI tools to create solutions for specific use cases
Deployment Engineer	Manage integration, deployment and operation of AI systems at enterprise scale, including network and compute infrastructure and data engineering pipelines	Knowledge Operations Manager: 3D	Network Infrastructure Engineer, Information Technician	<ul style="list-style-type: none"> Manages systems, infrastructure Understanding of deployment constraints (bandwidth limitations, security, etc.)

12.1.3 Workforce Sizing

Preliminary workforce sizing estimates are included as an order of magnitude estimate only. They are not intended to provide a definitive view of the size of the DoD workforce in each concentration. Instead, they are meant to provide insight into the potential scale of the required learning program and are used to inform the modalities through which the “Create AI” curriculum is delivered as well as its implementation. Values represent the number of individuals that either currently fulfill the requirements of the archetype or have the potential to be upskilled with the archetype.

Concentration	# MIL (K) 2017 ²²	# CIV (K) 2017
AI Researcher	Very Small	Very Small
AI/ML Engineer	Very Small	Small
Test & Evaluation Engineer	Small	Medium
Data Scientist	Small	Small
Deployment Engineer	Small	Small

12.2 Learning Outcomes

At the conclusion of the AI education and training program, the “Create AI” archetype should be able to achieve the following learning outcomes:

- Develop and productionalize a wide-array of ethical AI applications
- Determine which AI capability is most applicable to the use case
- Industrialize solutions to support enterprise-scale application

²² Very small is less than 1,000; small is 1,000-10,000; medium is 10,000-20,000; large is 20,000-100,000; very large is 100,000+

DoD AI Education Strategy

12.3 Competencies

Competencies are a catch-all term for the knowledge, skills, abilities, and other attributes expected of each archetype. AI competencies were developed using existing AI/digital workforce efforts of DoD and the commercial sector. Competencies provide guidance that is specific, yet flexible enough to accommodate a rapidly evolving talent market and Component-specific requirements.

Figure 17. Create AI: Relevant Competencies and Associated Curriculum

Competency Topic	Competencies	Curriculum
1 Foundational Concepts	• Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack	
	• Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements for the successful delivery of AI tools	
	• Advanced AI concepts: Understanding advanced and state-of-the-art AI methods	
2 AI Applications: Opportunities and Risks	• Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research	
	• Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD	
3 Data Management & Visualization	• Managing data: Understanding how to collect, store, and monitor data	
	• Visualizing data: Knowing how to structure and display data, as well as use data to create a story	
	• Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models	
4 Responsible AI	• Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations	
5 Infrastructure, Coding, and Software Development	• Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL	
	• Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models	
	• Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools	
	• Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing	
	• Testing AI: Using models and prediction methods for evaluating AI performance	
	• DevSecOps: Understanding how to automate development, testing, securing, and deploying AI/ML-enabled software to the DoD	
6 Mathematics, Statistics, and Data Science	• AI frameworks: Understanding of the common frameworks used to implement AI methods	
7 AI Delivery	• Performing analysis: Applying mathematical tools, (e.g. customized models / algorithms, predictive analytics) for AI tool dev	
8 AI Enablement	• Managing product development: Understanding AI project management, including product development & prototyping	
	• Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users	
	• Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy	
	• User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment	
	• Legal/IP Rights: Understanding of data rights, property rights, and intellectual property	

Curriculum depth:  Basic  Intermediate  Advanced

DoD AI Education Strategy

12.4 Curriculum Building Blocks

Within each concentration, there is a minimum set of knowledge, skills, and abilities to address the future AI competencies needed within DoD. These competencies are organized into a curriculum to provide a guideline of coursework that satisfies FY20 NDAA Sec. 256 curriculum requirements. The suggested curriculum is intended to guide Components' AI education paths, not stifle existing initiatives. Minimum requirements for each concentration are represented at a high level below, which inform the curriculum for each concentration. There can be a technical and non-technical journey dependent on each concentration's needs.

	Applicable to all concentrations	AI Researcher	AI/ML Engineer	Testing & Evaluation Engineer	Data Scientist	Deployment Engineer
1 Foundational Concepts	<ul style="list-style-type: none"> Understand core concepts of AI and big data tools Understand how AI enables new kinds of working, and design choices reflecting those changes 					
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none"> Evaluate use cases for potential impact and development potential Develop paths forward to take AI solutions from design to prototype Operate as an effective unit within an agile, digital-centered team Communication trends and opportunities to leaders across organization 	<ul style="list-style-type: none"> Aware of trends in AI and implications for potential DoD use cases 	<ul style="list-style-type: none"> Aware of technical trends in AI and implications for potential DoD use cases 	<ul style="list-style-type: none"> Familiar with best practice testing / evaluation techniques for AI systems (e.g. accuracy, AUC) 	<ul style="list-style-type: none"> Apply AI tools to address specific use cases 	<ul style="list-style-type: none"> Understand deployment constraints Manage network/systems infrastructure
3 Data Management and Visualization		<ul style="list-style-type: none"> Capable of communicating latest trends in AI and potential implications for DoD to a non-technical audience via visualizations 		<ul style="list-style-type: none"> Capable of communicating AI system performance to non-technical audience 	<ul style="list-style-type: none"> Strong data visualization skills to express system outputs in straightforward, compelling ways 	<ul style="list-style-type: none"> Collect data from multiple sources Perform network management/traffic analysis
4 Responsible AI	<ul style="list-style-type: none"> Understand recent literature on AI ethics and safety, as well as their implications for DoD efforts 					
5 Infrastructure, Coding, and Software Development	<ul style="list-style-type: none"> Understand how to bring AI use cases into production Leverage grasp of data engineering and management, software engineering, or programming to build AI tools 	<ul style="list-style-type: none"> Pioneer novel techniques, new models, and algorithms 	<ul style="list-style-type: none"> Understand how to build & test AI tools, ML algorithms and frameworks (e.g., TensorFlow, PyTorch, etc.) Software engineering and development Code and program with wide-ranging expertise 	<ul style="list-style-type: none"> Understand and identify AI failure modes Perform operations-based testing Develop T&E infrastructure 	<ul style="list-style-type: none"> Advanced analytics (predictive modeling, clustering, Python, SQL, etc.) Perform DevOps Understand how to manage data infrastructure 	
6 Mathematics, Statistics, and Data Science	<ul style="list-style-type: none"> Support the creation of AI tools by leveraging deep knowledge of AI concepts, theoretical and applied 	<ul style="list-style-type: none"> Conduct research (e.g., DL, BERT, Reinforced learning, etc.) Drive AI innovation in theory and application 				
7 AI Delivery	<ul style="list-style-type: none"> Understand agile ways of working Understand best practices for creating a culture of communication and collaboration across teams 					
8 AI Enablement	<ul style="list-style-type: none"> Understand fundamentals of design thinking Incorporate design thinking into research, design and development of AI tools Understand legal and intellectual property considerations with respect to AI capabilities 					

DoD AI Education Strategy

12.5 Learning Journey

The learning journey leverages commercial efforts and adult learning best practices to provide guidance on curriculum design, content, and delivery. It is intended to serve as guidance to the Components and repurposed to fit their specific context. The learning journey is not meant to be a one-size-fits-all approach to AI education and is not a prescriptive implementation plan.

The learning journey outlines how the “Create AI” curriculum will be delivered across time and modality to address the archetype specific competency requirements and meet the defined learning outcomes. Given the competency requirements for “Create AI”, a blended approach to curriculum delivery is recommended:

Figure 18. Create AI: Learning Journey for AI/ML Engineers²³

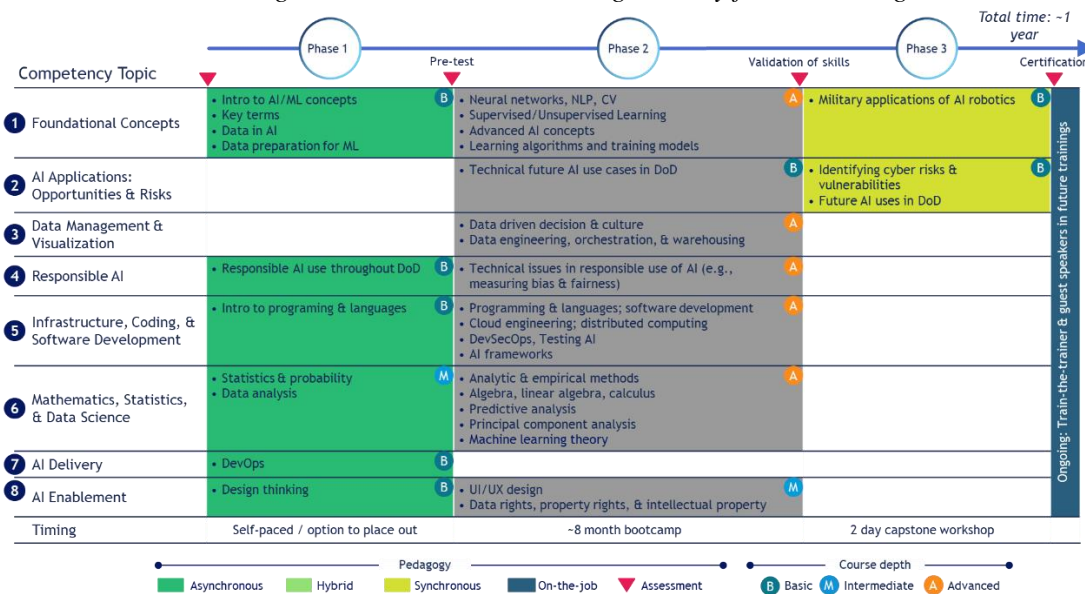
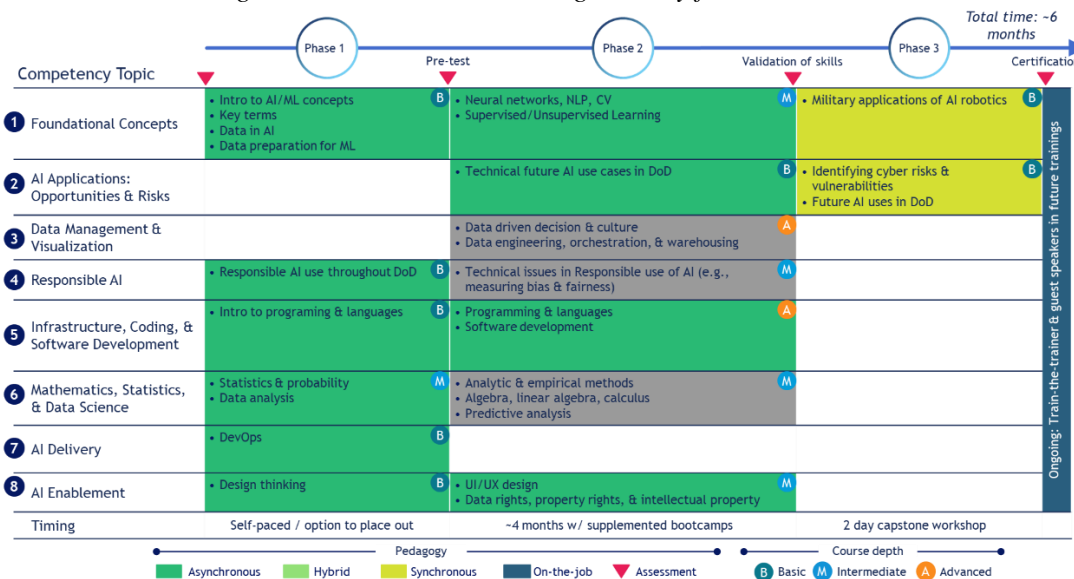


Figure 19. Create AI: Learning Journey for All Other Concentrations



²³ Bootcamps reference intensive, synchronous courses designed to teach technical skills.

13 Appendix E: Embed AI Worker Archetype

13.1 Workforce Framework

13.1.1 Archetype

Embedded with end users, this person will ensure AI tools are used effectively to support mission requirements. This person will manage data collection streams downrange and route information back to “Create AI” personnel. Maintainers of AI will also be able to support AI end users identify, troubleshoot, and provide basic fixes of AI/ML systems; they will not be full-scale developers and programmers.

Key responsibilities include:

- Demonstrate fundamental understanding of AI/ML concepts, programming, and data architecture
- Understand data streams and architecture; create datalinks to gather and send data to developers

13.1.2 Archetype Concentrations

The Embed AI archetype is composed of only one clearly defined concentration that is reflective of roles across the Components.

Embed AI Concentration	Role description	Example MIL specialties	Example CIV careers	Key differentiations in AI use
Technician	Set up systems to collect and analyze data; troubleshoots ML models	Air Force 2A, 3D Navy CWE: 1840	Information Technician	<ul style="list-style-type: none"> • Able to create data capture and sharing systems downrange • Understand AI tools and coding to identify and troubleshoot issues in models • Provide first line defense for AI end users to get help with use of AI tools

DoD AI Education Strategy

13.1.3 Workforce sizing

Preliminary workforce sizing estimates are included as an order of magnitude estimate only. They are not intended to provide a definitive view of the size of the DoD workforce in each concentration. Instead, they are meant to provide insight into the potential scale of the required learning program and are used to inform the modalities through which the “Embed AI” curriculum is delivered as well as its implementation. Values represent the number of individuals that either currently fulfill the requirements of the archetype or have the potential to be upskilled with the archetype.

Concentration	# MIL (K) 2017 ²⁴	# CIV (K) 2017
Technician	Large	Unknown

13.2 Learning Outcomes

At the conclusion of the AI education and training program, the “Embed AI” archetype should be able to demonstrate the following learning outcomes:

- Support use case development by solving down-range infrastructure constraints
- Analyze and aggregate data in preparation of ethical AI application development
- Solve AI application issues down-range to maintain functionality

²⁴ Very small is less than 1,000; small is 1,000-10,000; medium is 10,000-20,000; large is 20,000-100,000; very large is 100,000+

DoD AI Education Strategy

13.3 Competencies

Competencies are a catch-all term for the knowledge, skills, abilities, and other attributes expected of each archetype. AI competencies were developed using existing AI/digital workforce efforts of DoD and the commercial sector. Competencies provide guidance that is specific, yet flexible enough to accommodate a rapidly evolving talent market and Component-specific requirements.

Figure 20. Embed AI: Relevant Competencies and Associated Curriculum

Competency Topic	Competencies	Curriculum
1 Foundational Concepts	• Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack	M
	• Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements for the successful delivery of AI tools	M
	• Advanced AI concepts: Understanding advanced and state-of-the-art AI methods	M
2 AI Applications: Opportunities and Risks	• Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research	B
	• Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD	B
3 Data Management & Visualization	• Managing data: Understanding how to collect, store, and monitor data	A
	• Visualizing data: Knowing how to structure and display data, as well as use data to create a story	B
	• Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models	A
4 Responsible AI	• Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations	B
5 Infrastructure, Coding, and Software Development	• Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL	M
	• Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models	A
	• Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools	M
	• Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing	B
	• Testing AI: Using models and prediction methods for evaluating AI performance	A
	• DevSecOps: Understanding how to automate development, testing, securing, and deploying AI/ML-enabled software to the DoD	
	• AI frameworks: Understanding of the common frameworks used to implement AI methods	A
6 Mathematics, Statistics, and Data Science	• Performing analysis: Applying mathematical tools, (e.g. customized models / algorithms, predictive analytics) for AI tool dev	B
7 AI Delivery	• Managing product development: Understanding AI project management, including product development & prototyping	B
	• Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users	B
	• Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy	B
8 AI Enablement	• User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment	B
	• Legal/IP Rights: Understanding of data rights, property rights, and intellectual property	B

Curriculum depth: B Basic M Intermediate A Advanced

DoD AI Education Strategy

13.4 Curriculum Building Blocks

Within each concentration, there is a minimum set of knowledge, skills, and abilities to address the future AI competencies needed within DoD. These competencies are organized into a curriculum to provide a guideline of coursework that satisfies FY20 NDAA Sec. 256 curriculum requirements. The suggested curriculum is intended to guide Components' AI education paths, not stifle existing initiatives. Minimum requirements for each concentration are represented at a high level below, which inform the curriculum for each concentration. There can be a technical and non-technical journey dependent on each concentration's needs.

Technician	
1 Foundational Concepts	<ul style="list-style-type: none">• Understand basic AI principles and how they inform application use cases• Understand common technical challenges associated with AI deployment
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none">• Leverage external resources to address emerging or novel problems associated with AI systems• Configure and validate network workstations and peripherals in accordance with approved standards and/or specifications• Serve as first line of defense for AI end users to get help with how to use AI tools
3 Data Management and Visualization	<ul style="list-style-type: none">• Understand how to create data capture and sharing systems downrange for AI tools• Set up systems to collect data and troubleshoot ML models
4 Responsible AI	<ul style="list-style-type: none">• Design incident response for AI and cloud service models• Escalate concerns about ethical and safety issues
5 Infrastructure, Coding, and Software Development	<ul style="list-style-type: none">• Understand AI tools and coding enough to identify and troubleshoot issues in systems• Identify possible causes of degradation of AI system performance or availability• Troubleshoot hardware and software solutions to optimize AI tool performance
6 Mathematics, Statistics, and Data Science	<ul style="list-style-type: none">• Understand statistical concepts underlying AI models and use to troubleshoot AI tools
7 AI Delivery	<ul style="list-style-type: none">• Understand agile ways of working• Facilitate implementation of AI by troubleshooting tools with end users• Support product development by structuring data properly down-range
8 AI Enablement	<ul style="list-style-type: none">• Understand legal and intellectual property considerations with respect to AI capabilities

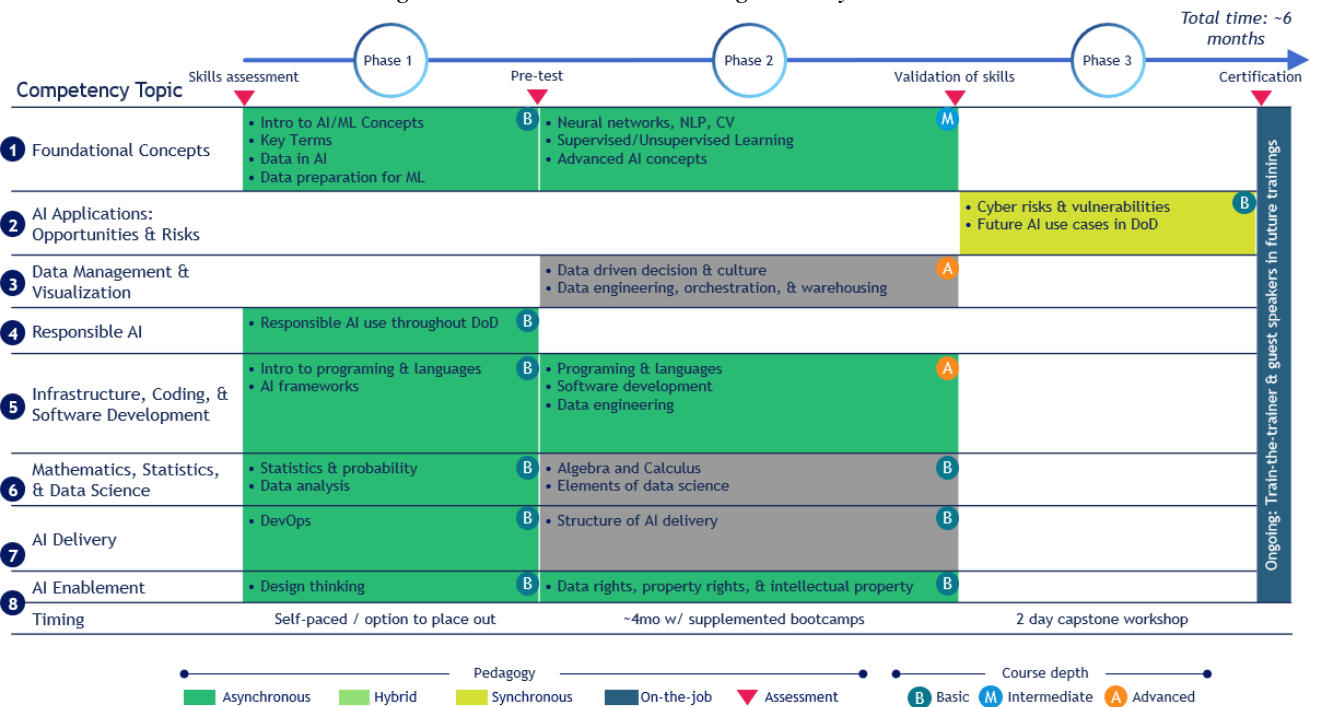
DoD AI Education Strategy

13.5 Learning Journey

The learning journey leverages commercial efforts and adult learning best practices to provide guidance on curriculum design, content, and delivery. It is intended to serve as guidance to the Components and repurposed to fit their specific context. The learning journey is not meant to be a one-size-fits-all approach to AI education and is not a prescriptive implementation plan.

The learning journey outlines how the “Embed AI” curriculum will be delivered across time and modality to address the archetype specific competency requirements and meet the defined learning outcomes. Given the competency requirements for “Embed AI”, a blended approach to curriculum delivery is recommended:

Figure 21. Embed AI: Learning Journey



14 Appendix F: Facilitate AI Worker Archetype

14.1 Workforce Framework

14.1.1 Archetype

This person is responsible for bridging the gap between “Employ AI” and “Create AI” archetypes. As the voice of the customer, this person represents the needs of end-users with AI tool developers. Additionally, this person will lead the integration of AI tools into business and operational processes.

Key responsibilities include:

- Communicate value of AI to end users
- Understand the needs and capabilities of end users; relay requirements to AI tool developers

14.1.2 Archetype Concentrations

Even within the “Facilitate AI” archetype, not all individuals will have the same education and training needs. The “Facilitate AI” archetype clearly defines concentrations that are reflective of roles across the Components. These concentrations ensure the “Facilitate AI” learning journey accounts for meaningful differentiation between each group. While the skillset requirements will be similar across concentrations, the application of those skillsets may vary; therefore, archetype concentrations allow for specialization within learning journeys.

Facilitate AI Concentration	Role description	Example CIV careers	Key differentiations in AI use
Product Owner	Turn product vision into actionable backlog; voice of customer to ensure requirements match user needs	Supply Program Manager, Management and Program Analysis	<ul style="list-style-type: none"> • Advocating for end users' needs in front of AI development team • Optimize AI tool development process
UI/UX	Design AI tool interface for usability and accessibility	UX Designer	<ul style="list-style-type: none"> • Ensure AI tool interface supports end user accessibility • Know how to collaborate with Create AI personnel to add end user specifications • Shape ways in which users interact with AI systems
Other Technical Experts	Manage functionality of non-AI components of technical tools	Full-stack developer, Web developer, Systems admin	<ul style="list-style-type: none"> • Basic level of AI knowledge needed to supplement regular technical job requirements

DoD AI Education Strategy

14.1.3 Workforce sizing

Preliminary workforce sizing estimates are included as an order of magnitude estimate only. They are not intended to provide a definitive view of the size of the DoD workforce in each concentration. Instead, they are meant to provide insight into the potential scale of the required learning program and are used to inform the modalities through which the “Facilitate AI” curriculum is delivered as well as its implementation. Values represent the number of individuals that either currently fulfill the requirements of the archetype or have the potential to be upskilled with the archetype.

Concentration	# MIL (K) 2017 ²⁵	# CIV (K) 2017
Product Owner	Unknown	Large
UI/UX	Very Small	Very Small
Other Technical Experts	Large	Large

14.2 Learning Outcomes

At the conclusion of the AI education and training program, the Facilitate AI archetype should demonstrate the following learning outcomes:

- Illustrate end-user needs to ensure they are built into application functionality
- Apply end-use needs to AI tool interface
- Analyze and simplify system outputs to support clear, and ethical enterprise decision-making

²⁵ Very small is less than 1,000; small is 1,000-10,000; medium is 10,000-20,000; large is 20,000-100,000; very large is 100,000+

DoD AI Education Strategy

14.3 Competencies

Competencies are a catch-all term for the knowledge, skills, abilities, and other attributes expected of each archetype. AI competencies were developed using existing AI/digital workforce efforts of DoD and the commercial sector. Competencies provide guidance that is specific, yet flexible enough to accommodate a rapidly evolving talent market and Component-specific requirements.

Figure 22. Facilitate AI: Relevant Competencies and Associated Curriculum

Competency Topic	Competencies	Curriculum
1 Foundational Concepts	• Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack	B
	• Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements for the successful delivery of AI tools	M
	• Advanced AI concepts: Understanding advanced and state-of-the-art AI methods	B
2 AI Applications: Opportunities and Risks	• Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research	M
	• Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD	M
3 Data Management & Visualization	• Managing data: Understanding how to collect, store, and monitor data	B
	• Visualizing data: Knowing how to structure and display data, as well as use data to create a story	B
	• Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models	B
4 Responsible AI	• Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations	M
	• Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL	B
5 Infrastructure, Coding, and Software Development	• Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models	
	• Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools	
	• Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing	
	• Testing AI: Using models and prediction methods for evaluating AI performance	B
	• DevSecOps: Understanding how to automate development, testing, securing, and deploying AI/ML-enabled software to the DoD	
6 Mathematics, Statistics, and Data Science	• AI frameworks: Understanding of the common frameworks used to implement AI methods	B
	• Performing analysis: Applying mathematical tools, (e.g. customized models / algorithms, predictive analytics) for AI tool dev	
7 AI Delivery	• Managing product development: Understanding AI project management, including product development & prototyping	B
	• Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users	B
	• Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy	B
8 AI Enablement	• User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment	M
	• Legal/IP Rights: Understanding of data rights, property rights, and intellectual property	B

Curriculum depth: B Basic M Intermediate A Advanced

DoD AI Education Strategy

14.4 Curriculum Building Blocks

Within each concentration, there is a minimum set of knowledge, skills, and abilities to address the future AI competencies needed within DoD. These competencies are organized into a curriculum to provide a guideline of coursework that satisfies FY20 NDAA Sec. 256 curriculum requirements. The suggested curriculum is intended to guide Components' AI education paths, not stifle existing initiatives. Minimum requirements for each concentration are represented at a high level below, which inform the curriculum for each concentration. There can be a technical and non-technical journey dependent on each concentration's needs.

	Applicable to all concentrations	Product Owner	UI/UX	Other Technical Experts
1 Foundational Concepts	<ul style="list-style-type: none"> Understand and be able to articulate AI knowledge, terms, and ideas Communicate the value of AI use cases to end users 		<ul style="list-style-type: none"> Understand how AI tools will be used to support mission objectives and consequent design requirements 	<ul style="list-style-type: none"> Understand basic AI/ML concepts and how they might affect non-AI tech
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none"> Understand AI tool development process Articulate problems and limitations of AI tools and report to creators of AI tools Predict future tools that could benefit end users 	<ul style="list-style-type: none"> Understand requirements of end users and capabilities of developers Optimize AI tool development process Turn product vision into actionable backlog 	<ul style="list-style-type: none"> Identify best-practice design choices based on application use case 	
3 Data Management and Visualization	<ul style="list-style-type: none"> Understand data visualization through end user perspective Articulate requirements for visualization to maximize end user functionality 			
4 Responsible AI	<ul style="list-style-type: none"> Foresee potential ethical issues of new AI tools 	<ul style="list-style-type: none"> Track all ethics and safety related concerns, addressing them through appropriate channels 	<ul style="list-style-type: none"> Ensure UI/UX reflects organizational AI principles and policies 	
5 Infrastructure, Coding, and Software Development				<ul style="list-style-type: none"> Perform software development, particularly web / front-end development
7 AI Delivery	<ul style="list-style-type: none"> Understand the needs of end users Understand how to interact with Develop AI teams to provide input on AI tools Redesign business and operational processes to be "AI ready" Bridge the gap between end users (Employ AI) and developers (Create AI) 	<ul style="list-style-type: none"> Communicate between end users and developers 	<ul style="list-style-type: none"> Deploy big data technology (ELK, Splunk, Hadoop, etc.) 	<ul style="list-style-type: none"> Manage functionality of non-AI components of technical tools Develop processes to ensure interoperability of analytical solutions
8 AI Enablement	<ul style="list-style-type: none"> Communicate design preferences / requirements to end users or developers, as appropriate Understand legal and intellectual property considerations with respect to AI capabilities 		<ul style="list-style-type: none"> Leverage human-centered design (UI/UX) Prototype design Conduct feature engineering Design AI tool interface for usability and accessibility Creative collaboration with end users and developers 	

DoD AI Education Strategy

14.5 Learning Journey

The learning journey leverages commercial efforts and adult learning best practices to provide guidance on curriculum design, content, and delivery. It is intended to serve as guidance to the Components and repurposed to fit their specific context. The learning journey is not meant to be a one-size-fits-all approach to AI education and is not a prescriptive implementation plan.

The learning journey outlines how the “Facilitate AI” curriculum will be delivered across time and modality to address the archetype specific competency requirements and meet the defined learning outcomes. Given the competency requirements for “Facilitate AI”, a blended approach to curriculum delivery is recommended:

Figure 23. Facilitate AI: Learning Journey



15 Appendix G: Employ AI Worker Archetype

15.1 Workforce Framework

15.1.1 Archetype

As an end user of AI-enabled technology, this person represents the majority of the DoD workforce. While not a technical expert, this person must understand foundational AI concepts, how to use AI tools created for them, how to identify questionable outputs, and know the process to report new requirements.

Key responsibilities include:

- Understand how to apply AI insights and tools to enhance performance of their job
- Know the process to raise new requirements, and request new tools

15.1.2 Archetype Concentrations

Even within the “Employ AI” archetype, not all individuals will have the same education and training needs. The “Employ AI” archetype clearly defines concentrations that are reflective of roles across the Components. These concentrations ensure the “Employ AI” learning journey accounts for meaningful differentiation between each group. While the skillset requirements will be similar across concentrations, the application of those skillsets may vary; therefore, archetype concentrations allow for specialization within learning journeys.

Employ AI Concentration	Role description	Example MIL/CIV specialties	Key differentiations in AI use
Operations	DoD Warfighter; combat-facing roles	Pilot, SWO, Infantry	<ul style="list-style-type: none"> • AI strengthens warfighting / mission functions
Intelligence	Gathers and analyzes information to support decision-making	Intelligence analyst, Cryptology specialist, ISR manager	<ul style="list-style-type: none"> • AI enables information gathering, analysis and reduces information delivery cycle time
Logistics and Maintenance	Enable troop / gear movement, maintain equipment	Maintainer, repairer, Procurement manager	<ul style="list-style-type: none"> • AI supports distribution, sustainment, and maintenance needs
Health	Maintain health and wellbeing of the Warfighter	Medical, Doctor, Nurse, Medic	<ul style="list-style-type: none"> • AI supports maintaining and improving welfare of DoD personnel
Support	Other focused support to the Warfighter	Legal, Personnel	<ul style="list-style-type: none"> • AI used to support the warfighter

DoD AI Education Strategy

15.1.3 Workforce sizing

Preliminary workforce sizing estimates are included as an order of magnitude estimate only. They are not intended to provide a definitive view of the size of the DoD workforce in each concentration. Instead, they are meant to provide insight into the potential scale of the required learning program and are used to inform the modalities through which the “Employ AI” curriculum is delivered as well as its implementation. Values represent the number of individuals that either currently fulfill the requirements of the archetype or have the potential to be upskilled with the archetype.

Concentration	# MIL (K) 2017 ²⁶	# CIV (K) 2017
Operations, Intel, Logistics and Maintenance, Health, Support	Very Large	Very Large

15.2 Learning Outcomes

At the conclusion of the AI education and training program, the “Employ AI” archetype should be able to demonstrate following learning outcomes:

- Interpret AI application output to inform decision making
- Understand AI concepts and recognize potential future applications
- Demonstrate proficiency related to engaging with and interpreting AI application

²⁶ Very small is less than 1,000; small is 1,000-10,000; medium is 10,000-20,000; large is 20,000-100,000, very large is 100,000+

DoD AI Education Strategy

15.3 Competencies

Competencies are a catch-all term for the knowledge, skills, abilities, and other attributes expected of each archetype. AI competencies were developed using existing AI/digital workforce efforts of DoD and the commercial sector. Competencies provide guidance that is specific, yet flexible enough to accommodate a rapidly evolving talent market and Component-specific requirements.

Figure 24. Employ AI: Relevant Competencies and Associated Curriculum

Competency Topic	Competencies	Curriculum
1 Foundational Concepts	• Understanding AI: Conceptualizing probabilistic reasoning and core elements of AI stack	B
	• Applying AI: Interpreting AI output and recognizing potential use cases, as well as understanding the basic requirements for the successful delivery of AI tools	B
	• Advanced AI concepts: Understanding advanced and state-of-the-art AI methods	
2 AI Applications: Opportunities and Risks	• Identifying trends: Recognizing emerging trends in AI, as well as opportunities for research	B
	• Identifying risks: Recognizing data and network security and privacy risks that come with AI, as well as AI bias, complementary compliance, incident response policies, and unique challenges to DoD	B
3 Data Management & Visualization	• Managing data: Understanding how to collect, store, and monitor data	B
	• Visualizing data: Knowing how to structure and display data, as well as use data to create a story	B
	• Data preparation: Preparing structured or unstructured data so that it is usable and meaningful to models	B
4 Responsible AI	• Operating ethically and legally: Understanding the ethical issues related to AI and adhering to all relevant regulations	B
5 Infrastructure, Coding, and Software Development	• Programming and scripting: Knowing how to code in languages that support AI tool development and data analysis, e.g., Java, Python, SQL	
	• Software engineering: Understanding how to build effective software in the most efficient manner, including knowledge of DevOps, full stack development, and integration of established algorithms and pre-trained models	
	• Operating in cloud: Understanding various cloud services, cloud-native architectures, orchestration tools	
	• Computing: Understanding basic computing concepts (e.g., fog computing), and being able to differentiate different forms of computing	
	• Testing AI: Using models and prediction methods for evaluating AI performance	
	• DevSecOps: Understanding how to automate development, testing, securing, and deploying AI/ML-enabled software to the DoD	
6 Mathematics, Statistics, and Data Science	• AI frameworks: Understanding of the common frameworks used to implement AI methods	
	• Performing analysis: Applying mathematical tools, (e.g. customized models / algorithms, predictive analytics) for AI tool dev	
7 AI Delivery	• Managing product development: Understanding AI project management, including product development & prototyping	
	• Overseeing AI delivery: Understanding management of an AI delivery team, the structure and operating model, and effective planning, as well as how to facilitate the implementation of these tools by end users	
	• Leading AI strategy: Knowing best practice for implementing AI on a large scale as well as AI's impact on strategy	
8 AI Enablement	• User-centric design: Integrating Design Thinking, human-centered design, UX / HCI into system development & deployment	B
	• Legal/IP Rights: Understanding of data rights, property rights, and intellectual property	

Curriculum depth: B Basic M Intermediate A Advanced

DoD AI Education Strategy

15.4 Curriculum Building Blocks

Within each concentration, there is a minimum set of knowledge, skills, and abilities to address the future AI competencies needed within DoD. These competencies are organized into a curriculum to provide a guideline of coursework that satisfies FY20 NDAA Sec. 256 curriculum requirements. The suggested curriculum is intended to guide Components' AI education paths, not stifle existing initiatives. Minimum requirements for each concentration are represented at a high level below, which inform the curriculum for each concentration. There can be a technical and non-technical journey dependent on each concentration's needs.

	Applicable to all concentrations	Operations	Intel	Logistics & Maintenance	Health
1 Foundational Concepts	<ul style="list-style-type: none"> Understand how AI can enhance work performance Apply AI tools by leveraging knowledge of high-level AI concepts 	<ul style="list-style-type: none"> Understand how AI tools enhance warfighting performance 	<ul style="list-style-type: none"> Understand big data and data management 		<ul style="list-style-type: none"> Understand current and future use cases of AI to support health of DoD personnel
2 AI Applications: Opportunities and Risks	<ul style="list-style-type: none"> Understand use of AI tools and draw insights from them Understand current and future use cases of AI that affect area of focus Write requests for new AI tools and capabilities ID and troubleshoot issues in AI tools 		<ul style="list-style-type: none"> Leverage tools for data-driven decision making Use AI tools to enable information gathering & analysis 	<ul style="list-style-type: none"> Understand how AI can improve force movement Use of AI tools to maintain equipment 	<ul style="list-style-type: none"> Improve maintenance of health and wellness of warfighters through AI
3 Data Management and Visualization	<ul style="list-style-type: none"> Interpret output of AI tools and make data-driven decisions 				
4 Responsible AI	<ul style="list-style-type: none"> Understand bias, limitations, and discrimination in AI tech Escalate ethical and safety concerns 	<ul style="list-style-type: none"> Ethical and safe use of AI tools in warfighting 	<ul style="list-style-type: none"> Ethical and safe use of AI tools in operations 		<ul style="list-style-type: none"> Preservation of medical privacy
8 AI Enablement	<ul style="list-style-type: none"> Provide feedback to Develop AI group on AI tool utility and ease of use 				

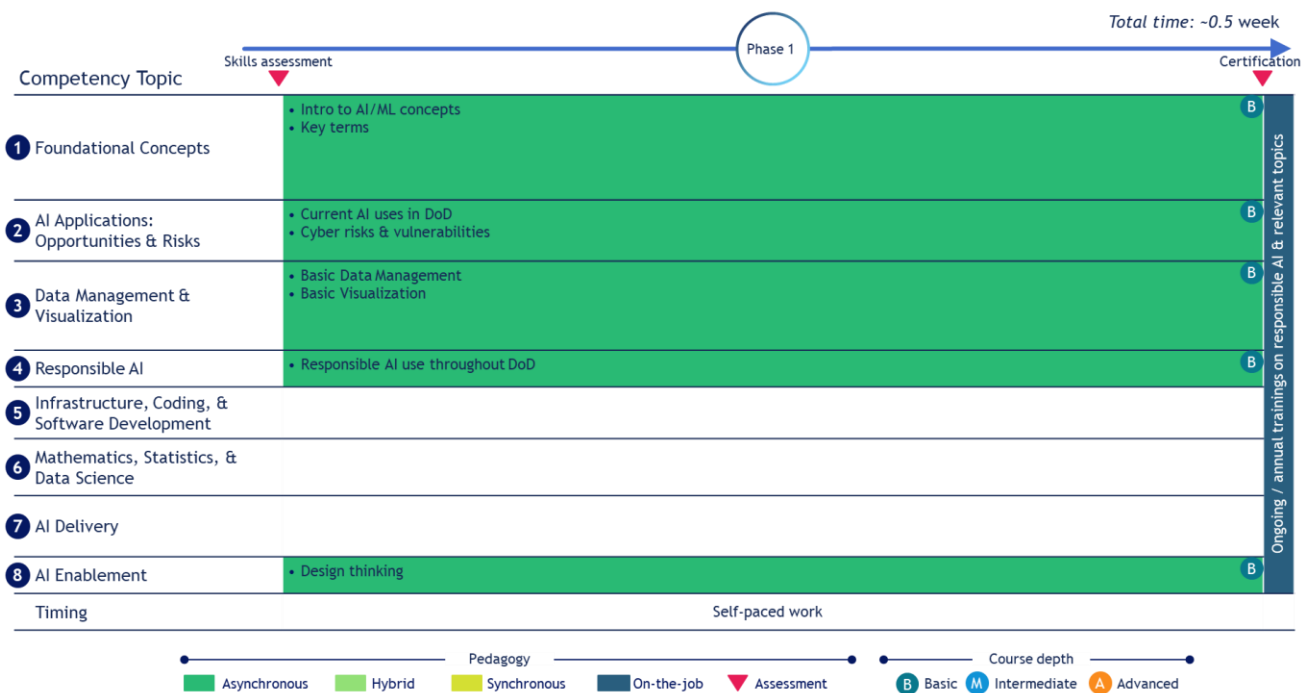
DoD AI Education Strategy

15.5 Learning Journey

The learning journey leverages commercial efforts and adult learning best practices to provide guidance on curriculum design, content, and delivery. It is intended to serve as guidance to the Components and repurposed to fit their specific context. The learning journey is not meant to be a one-size-fits-all approach to AI education and is not a prescriptive implementation plan.

The learning journey outlines how the “Employ AI” curriculum will be delivered across time and modality to address the archetype specific competency requirements and meet the defined learning outcomes. Given the competency requirements for “Employ AI”, a blended approach to curriculum delivery is recommended:

Figure 25. Employ AI: Learning Journey



16 Appendix H: Glossary

Term/Acronym	Definition
AI	Artificial Intelligence - The ability of machines to perform tasks that normally require human intelligence – recognizing patterns, learning from experience, drawing conclusions, making predictions, taking action, and more – whether digitally or as the smart software behind autonomous physical systems.
Asynchronous Learning	Student-centered teaching method that allows learning to occur in different times and spaces particular to each learner. Typically set up as self-paced learning virtual learning.
DoD	Department of Defense
FYDP	Future Years Defense Program
Infrastructure and Platform Services	JAIC is procuring the JCF, an enterprise-wide Artificial Intelligence/Machine Learning cloud platform that will give DoD access to AI/ML-enabled tools
IPT	Integrated Product Team
JAIC	Joint Artificial Intelligence Center - The DoD's AI Center of Excellence that provides a critical mass of expertise to help the Department harness the game-changing power of AI
JCF	Joint Common Foundation
JOTI	Joint Operational Technology Infrastructure
KPIs	Key Performance Indicators
ML	Machine Learning - A subfield of artificial intelligence, which enables machines to learn from past data or experiences without being explicitly programmed
NDAA	National Defense Authorization Act
NMIs	National Mission Initiatives - Pressing operational or business reform challenges, typically derived from National Defense Strategy key operational problems, that can only be solved by multi-Service innovation and the parallel introduction of new technology and new operational concepts
Synchronous Learning	All types of learning in which learner(s) and instructor(s) are in the same place, at the same time, in order for learning to take place
T&E	Training and Education
TMO	Transformation Management Office - coordinates, tracks, and enables AI awareness, education, and training efforts.
Total Force	Includes active-duty, government civilians, and reserve components
UI/UX	User Interface / User Experience