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June 2023

# ARTIFICIAL INTELLIGENCE

## DOD Needs Department-Wide Guidance to Inform Acquisitions

Accessible Version

# GAO Highlights

Highlights of [GAO-23-105850](#), a report to the Committee on Armed Services, U.S. Senate

## Why GAO Did This Study

DOD has begun to pursue increasingly advanced AI capabilities. DOD has historically struggled to acquire weapon systems software, and AI acquisitions pose additional challenges. In February 2022, GAO described the status of DOD's efforts to develop and acquire AI for weapon systems.

Senate Report 116-236 accompanying the National Defense Authorization Act for Fiscal Year 2021 includes a provision for GAO to review DOD's AI acquisition efforts. This is the second report in response to that provision. This report examines (1) key factors that selected private companies reported considering when acquiring AI capabilities, and (2) the extent to which DOD has department-wide AI acquisition guidance and how, if at all, this guidance reflects key factors identified by private sector companies.

GAO analyzed information provided by 13 private companies with expertise in designing, developing, and deploying AI systems in various sectors to determine the key factors. GAO also analyzed DOD documentation and compared it with the key factors, and interviewed DOD officials.

## What GAO Recommends

GAO is making four recommendations for DOD and the three military departments to develop guidance on acquiring AI capabilities, leveraging private company factors as appropriate. DOD concurred with the recommendations.

View [GAO-23-105850](#). For more information, contact Jon Ludwigson at (202) 512-4841 or [ludwigsonj@gao.gov](mailto:ludwigsonj@gao.gov).

June 2023

## ARTIFICIAL INTELLIGENCE

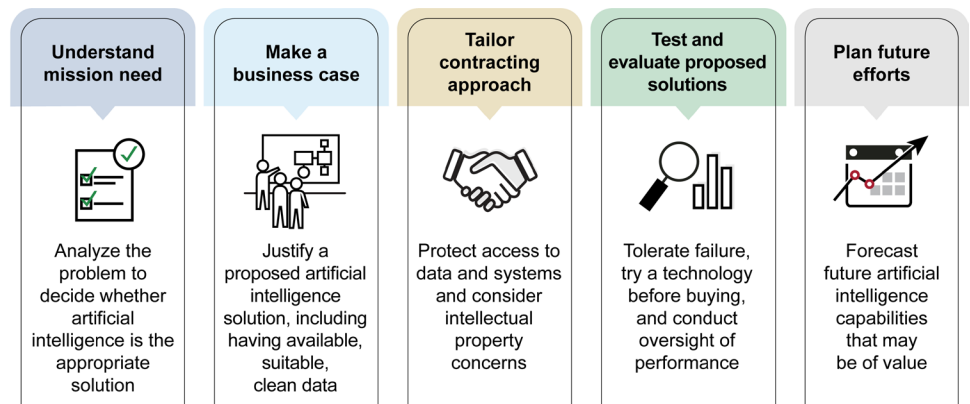
# DOD Needs Department-Wide Guidance to Inform Acquisitions

## What GAO Found

The Department of Defense (DOD) designated artificial intelligence (AI) a top modernization area and is allocating considerable spending to develop AI tools and capabilities. AI refers to computer systems designed to replicate a range of human functions and continually get better at their assigned tasks. DOD AI capabilities could be used in various ways, for example in identifying potential threats or targets on the battlefield.

GAO obtained information from 13 private sector companies about how they successfully acquire AI capabilities. Elements of these categories, shown below, are also reflected in GAO's June 2021 *AI Accountability Framework* report ([GAO-21-519SP](#)).

### Categories of Factors Selected Companies Reported Considering When Acquiring Artificial Intelligence Capabilities



Source: GAO analysis of private sector information; GAO (icons). | GAO-23-105850

Although numerous entities across DOD are acquiring, developing, or already using AI, DOD has not issued department-wide guidance for how its components should approach acquiring AI. DOD is in the process of planning to develop such guidance, but it has not defined concrete plans and has no timeline to do so. The military services also lack AI acquisition-specific guidance, though military officials noted that such guidance would be helpful to navigate the AI acquisition process. Without department-wide and tailored service-level guidance, DOD is missing an opportunity to ensure that it is consistently acquiring AI capabilities in a manner that accounts for the unique challenges associated with AI.

Various DOD components and military services have individually developed or plan to develop their own informal AI acquisition resources. Some of these resources reflect key factors identified by private companies for AI acquisition. For example, DOD's Chief Digital and AI Officer oversees an AI marketplace known as Tradewind, which is designed to expedite the procurement of AI capabilities. Several Tradewind resources emphasize the need to consider intellectual property and data rights concerns when negotiating contracts for AI capabilities, a key factor identified by the companies GAO interviewed.

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### Abbreviations

AI	artificial intelligence
DOD	Department of Defense

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June 29, 2023

The Honorable Jack Reed  
Chairman  
The Honorable Roger Wicker  
Ranking Member  
Committee on Armed Services  
United States Senate

The Department of Defense (DOD) has noted that artificial intelligence (AI) technology is poised to transform the future of warfare because AI-enabled machines can potentially maneuver and change tactics at speeds that human operators cannot.<sup>1</sup> The department has designated it a top modernization area and plans to spend \$16.5 billion on science and technology programs, including \$1.1 billion to directly support its AI efforts, in fiscal year 2023.<sup>2</sup> DOD AI capabilities could be used in various ways, for example, in identifying potential threats or targets on the battlefield.

The National Security Commission on Artificial Intelligence—established by law in 2018 to consider ways to advance the development of AI to address U.S. national security and defense needs—concluded in its March 2021 report that the U.S. is not prepared to defend itself in the AI era, and must act quickly to enable AI-readiness by 2025.<sup>3</sup> The commission further concluded that ensuring DOD has the necessary infrastructure, including tools and talent, in place will be essential to developing, acquiring, and scaling AI for weapon systems quickly and effectively.

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<sup>1</sup>For the purposes of this report, AI refers to machine learning capabilities, unless otherwise noted.

<sup>2</sup>Office of the Under Secretary of Defense (Comptroller) / Chief Financial Officer, *Defense Budget Overview; United States Department of Defense, Fiscal Year 2023 Budget Request* (April 2022).

<sup>3</sup>John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, § 1051 (2018). The National Security Commission on Artificial Intelligence, “Final Report” (March 1, 2021), accessed March 3, 2022, <https://www.nsc.ai.gov/2021-final-report/>.

We have reported for decades on DOD's challenges in acquiring software-intensive weapon systems.<sup>4</sup> In February 2022, we found that in addition to these challenges, DOD faces AI-specific challenges, including having usable data available to train the AI, because AI typically requires accurately labeled historical data to train the system so it can learn to accurately predict certain outcomes.<sup>5</sup>

Though DOD has recently begun to pursue increasingly advanced AI capabilities, the private sector has been acquiring and developing such capabilities for years.<sup>6</sup> Our prior work has demonstrated that, while structural differences between the private sector and government can affect outcomes, key principles from the private sector can be thoughtfully applied to government acquisition to improve outcomes, even with the different cultures and incentives.<sup>7</sup>

Given the growing significance of AI to DOD's acquisition goals, the Senate Report accompanying S. 4049, a bill for the National Defense Authorization Act for Fiscal Year 2021, includes a provision for GAO to review DOD AI acquisition-related efforts.<sup>8</sup> This is our second report in response to that provision.<sup>9</sup> This report examines (1) key factors that selected private sector companies reported considering when acquiring AI capabilities, and (2) the extent to which DOD's AI acquisition guidance, if any, reflects key factors identified by private sector companies.

To answer the first objective, we analyzed information obtained from a nongeneralizable selection of 13 companies with expertise in designing, developing, and deploying AI systems in a variety of business sectors, such as defense, banking, healthcare, and pharmaceutical, among others. We identified these companies through analysis of open source

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<sup>4</sup>For example, see GAO, *DOD Space Acquisitions: Including Users Early and Often in Software Development Could Benefit Programs*, [GAO-19-136](#) (Washington, D.C.: Mar. 18, 2019). A list of related GAO products is provided at the end of this report.

<sup>5</sup>GAO, *Artificial Intelligence: Status of Developing and Acquiring Capabilities for Weapon Systems*, [GAO-22-104765](#) (Washington, D.C.: Feb. 17, 2022).

<sup>6</sup>In this report, we use the term private sector or private sector company to indicate nongovernment commercial entities.

<sup>7</sup>GAO, *Leading Practices: Agency Acquisition Policies Could Better Implement Key Product Development Principles*, [GAO-22-104513](#) (Washington, D.C.: Mar. 10, 2022).

<sup>8</sup>S. Rep. No. 116-236, at 131 (2020).

<sup>9</sup>[GAO-22-104765](#).

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information and in consultation with internal subject matter experts. To answer the second objective, we interviewed DOD officials and analyzed available AI-specific DOD documentation to compare the results with the key factors identified by companies. For more details on our scope and methodology, see appendix I.

We conducted this performance audit from February 2022 to June 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

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### The Typical AI Life Cycle

While there are various definitions of AI, in general, AI refers to computer systems that are able to solve problems and perform tasks that have traditionally required human intelligence and that continually get better at their assigned tasks.<sup>10</sup> We previously reported in our 2021 *AI Accountability Framework* that the life cycle of an AI system can involve several phases: design, development, deployment, and continuous monitoring, which are often iterative and are not necessarily sequential.<sup>11</sup>

As shown in figure 1, the various phases involve, among other steps, articulating the system's concepts in design; collecting and processing data, building one or more models, and validating the system in development; piloting and ensuring regulatory compliance in deployment; and continuously assessing the system's impact and, if necessary, retiring an AI system from production in monitoring.

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<sup>10</sup>[GAO-22-104765](#).

<sup>11</sup>GAO, *Artificial Intelligence: An Accountability Framework for Federal Agencies and Other Entities*, [GAO-21-519SP](#) (Washington, D.C.: June 2021). This framework provides key principles and practices for federal agencies and other entities that are considering, selecting, and implementing AI systems throughout each phase of the life cycle. This work applies many of the framework's concepts. For more information on this framework, see appendix II.

Figure 1: Phases of the Artificial Intelligence (AI) Life Cycle



Source: GAO analysis of information from the Department of Defense (DOD) and academic experts. | GAO-23-105850



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## Differences between AI and Traditional Software

In February 2022, we reported on the differences between AI and traditional software, which DOD has historically faced challenges in developing, procuring, and deploying.<sup>12</sup> We reported that although AI is a software-centric capability, DOD recognized that developing and using it is different from traditional software in key ways.<sup>13</sup> Software is programmed to perform tasks based on static instructions written as code, producing the same result based on the instructions coded into the system. By contrast, AI is software that is programmed with general parameters for performing the applicable task (referred to as algorithms) so that the AI model can learn to perform the task and improve over time. For example, training an AI model to recognize a submarine from a video feed requires exposing the system to images labeled as submarines, potentially from different viewing angles. Staff involved in the training validate when the AI model identifies a submarine correctly and when it does not in order to improve the model's performance. In addition, data and computing power, among other things, are especially important for AI compared to traditional software.

Further, while various DOD officials generally agree that AI development should leverage Agile software development principles to keep pace with rapidly changing technologies, there are likely to be aspects of Agile that may look different for AI. For example, Agile software development focuses on fielding the most basic version of a program that adds value quickly followed by iterative product development to field improvements. Yet, since AI typically requires vast amounts of data to learn a function and can behave differently or unexpectedly once deployed, officials from the Joint AI Center and DOD's Defense Digital Service previously cautioned against rushing to a proof of concept or minimum viable product for AI capabilities that support warfighting operations. Given the need for data, training, and testing for operational usefulness, it may take longer to get to a minimally viable product for AI than for traditional software Agile projects. Once deployed, the AI capability should continue to get better at its task as it is exposed to more data, but needs to be

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<sup>12</sup>[GAO-22-104765](#).

<sup>13</sup>For the purposes of this report, we use the term traditional software to mean computer programs, procedures, rules, and possibly documentation and data pertaining to the operation of the computer system. Some examples of traditional software include enterprise systems, business systems, and combat systems.

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continuously monitored to ensure the new data are not negatively affecting performance.

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## Available AI Acquisition Pathways

DOD's traditional acquisition processes were designed for hardware intensive systems and were typically linear and time-consuming. In July 2017, we reported that the complexity and length of DOD's acquisition process was an impediment for industry to work with DOD on software development, among other things.<sup>14</sup> Similarly, in 2019, the Defense Innovation Board's Software Acquisition and Practices study highlighted DOD's lack of fast, Agile acquisition processes that incorporate cybersecurity, cross-service digital infrastructure, and pathways for cultivating digital talent as impediments to modern software.<sup>15</sup> The National Security Commission on AI also reported and industry group officials told us that this process is not well-suited to AI procurement and deployment.<sup>16</sup>

In January 2020, in part to address additional reforms directed by legislation, DOD reissued and updated its foundational acquisition guidance. It established the Adaptive Acquisition Framework, which includes six acquisition pathways based on the characteristics and risk profile of the system being acquired.<sup>17</sup> The National Security Commission on AI recognized this framework as a positive step for DOD's ability to acquire digital technologies, and recommended that DOD scale these structures, among others, to better support delivery of digitally enabled capabilities like AI. An official from the Office of the Under Secretary of Defense for Acquisition and Sustainment stated that the Software

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<sup>14</sup>GAO, *Military Acquisitions: DOD Is Taking Steps to Address Challenges Faced by Certain Companies*, [GAO-17-644](#) (Washington, D.C.: July 20, 2017).

<sup>15</sup>Defense Innovation Board, *Software Is Never Done: Refactoring the Acquisition Code for Competitive Advantage* (May 2019).

<sup>16</sup>National Security Commission on Artificial Intelligence, "Final Report." [GAO-22-104765](#).

<sup>17</sup>DOD's general acquisition processes for weapon systems are described in Department of Defense Directive 5000.01, *The Defense Acquisition System* (Sept. 9, 2020) (incorporating change 1, July 28, 2022); and Department of Defense Instruction 5000.02, *Operation of the Adaptive Acquisition Framework* (Jan. 23, 2020) (incorporating change 1, June 8, 2022).

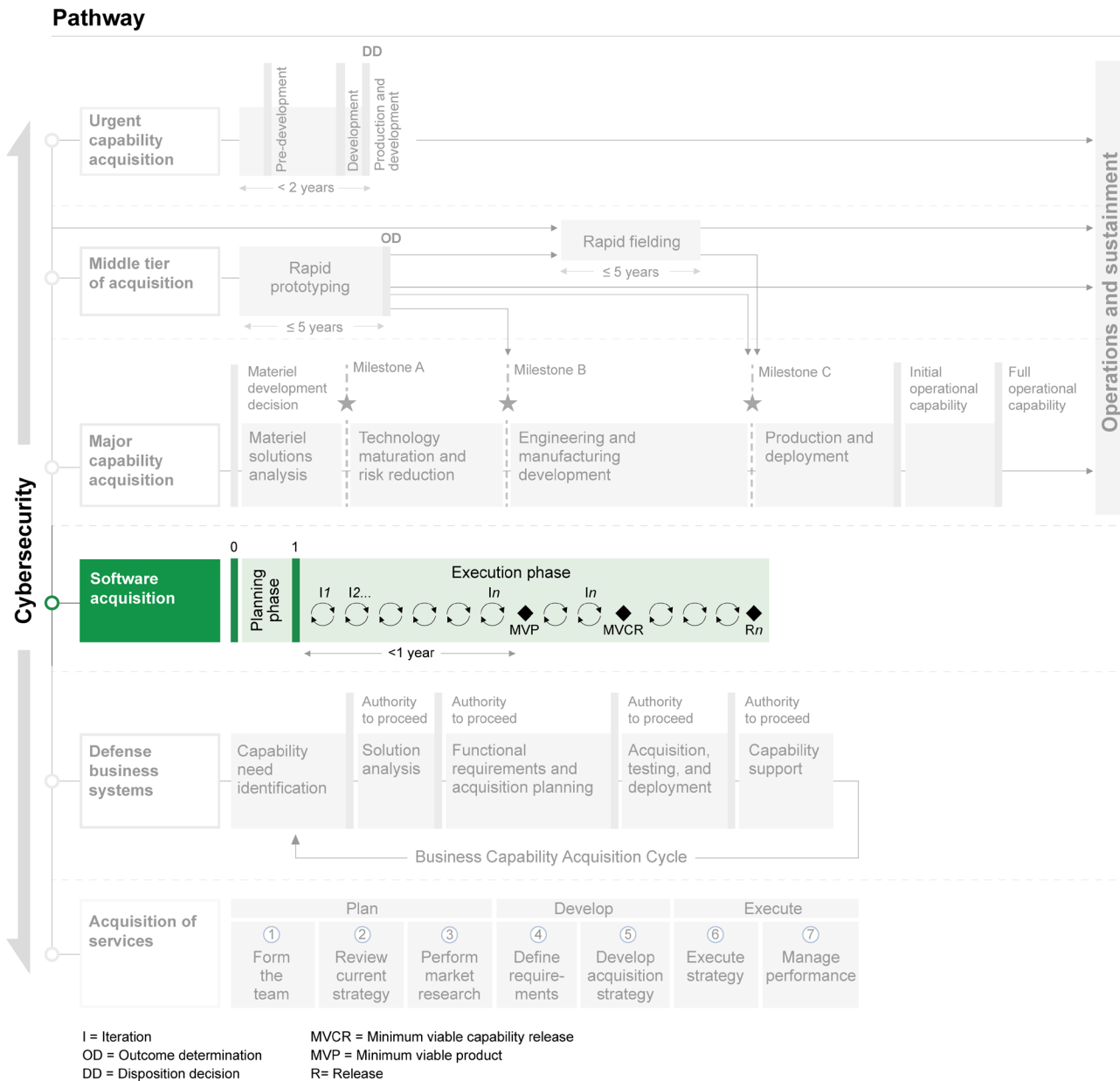
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Acquisition Pathway is the preferred pathway for AI capabilities.<sup>18</sup> Figure 2 shows the Adaptive Acquisition Framework, highlighting the Software Acquisition Pathway.

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<sup>18</sup>Department of Defense Instruction 5000.87, *Operation of the Software Acquisition Pathway* (Oct. 2, 2020). This pathway is designed for software-intensive systems to facilitate the rapid and iterative delivery of software capability to the user. It integrates modern software development practices with a focus on active user engagement. According to officials from the Office of the Under Secretary of Defense for Acquisition and Sustainment, 21 programs were using the software acquisition pathway as of July 2021. See [GAO-22-104765](#).

Figure 2: Adaptive Acquisition Framework Pathways



Source: GAO analysis of Department of Defense data. | GAO-23-105850

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## DOD Entities Involved with AI

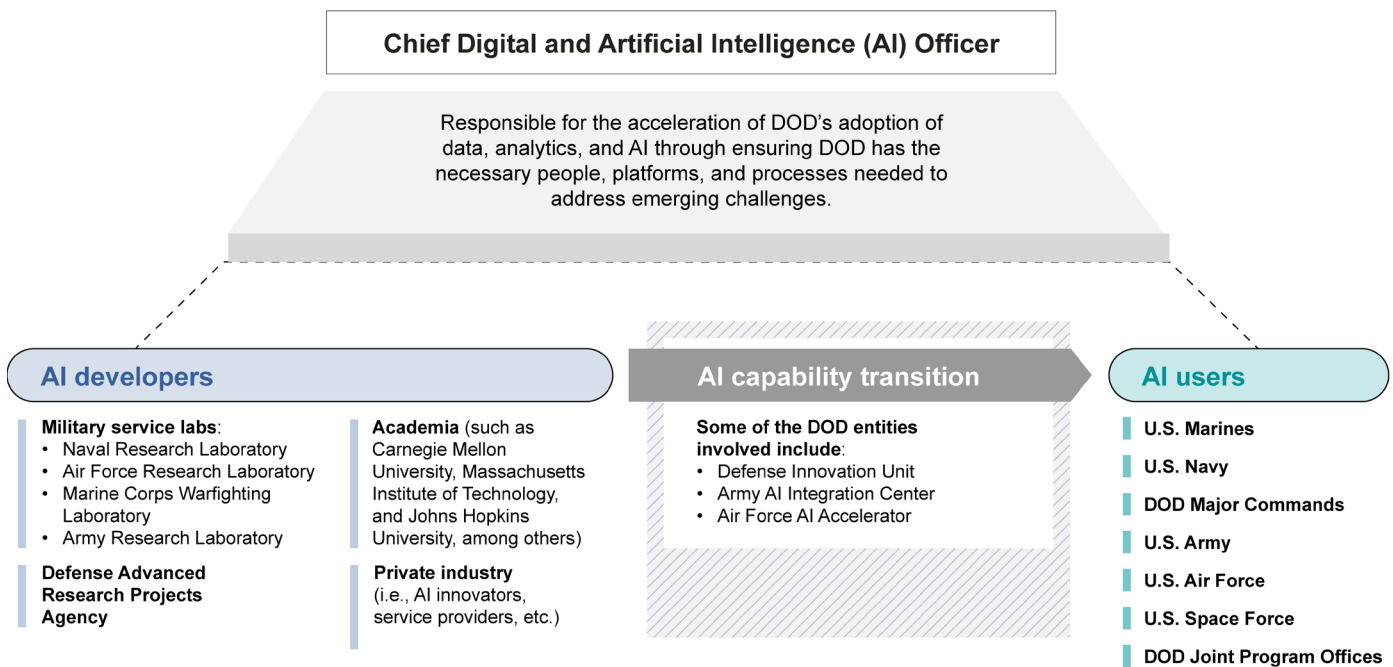
In December 2021, the Deputy Secretary of Defense issued a memorandum establishing, effective February 1, 2022, a new position, the Chief Digital and AI Officer, to serve as DOD's AI focal point.<sup>19</sup> The Chief Digital and AI Officer is responsible for leading and overseeing DOD's strategy development and policy formulation for data, analytics, and AI, and breaking down barriers to AI adoption, among other things. For the purposes of this report, guidance refers to policy and procedure documents such as DOD instructions or directives. Resources refer to informal, internal documents that may assist components in their work such as guidebooks or checklists. The Office of the Chief Digital and AI Officer is the successor organization to the Joint AI Center and integrated several previous DOD components, including the Defense Digital Service. The Chief Digital and AI Officer reports directly to the Deputy Secretary of Defense and has similar acquisition authority as previously granted to the Joint AI Center.

Additionally, various DOD entities such as the Defense Advanced Research Projects Agency, as well as academia and the private sector, are involved in the development, transition, and deployment of AI across the department, while the military services and major commands are the primary users of AI. The relationship of the Chief Digital and AI Officer to the various entities contributing to DOD's AI efforts is depicted in figure 3.

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<sup>19</sup>Deputy Secretary of Defense, *Establishment of the Chief Digital and Artificial Intelligence Officer*, Memorandum (Dec. 8, 2021).

**Figure 3: Entities Involved in Developing, Transitioning, and Using AI for DOD, as of January 2023**



Source: GAO depiction of Department of Defense (DOD) information. | GAO-23-105850

The Chief Digital and AI Officer oversees an AI marketplace known as Tradewind, which brings together DOD end users, private sector companies, and academia to expedite the procurement of AI capabilities. As we reported in February 2022, Tradewind serves as a new acquisition business model for AI. Its processes are intended to enable the department to quickly award Federal Acquisition Regulation-based contracts and other transaction agreements for prototypes with language suited to the unique aspects of AI, such as addressing intellectual property concerns and training data needs.<sup>20</sup> According to an official from the Office of the Under Secretary of Defense for Acquisition and Sustainment, the first agreements under Tradewind were awarded in early 2021, and the department expects to make dozens of awards via Tradewind in fiscal year 2023.

In March 2022, we found that while DOD is making organizational changes and investing billions of dollars to incorporate AI technology, the department risked a fragmented approach that could lead to unnecessary

<sup>20</sup>[GAO-22-104765](#).

duplication and overlap in the future, among other things, unless it collaborated effectively across the AI landscape.<sup>21</sup> We recommended, among other things, that the Deputy Secretary of Defense issue guidance that defines outcomes and monitors accountability for AI-related activities, and includes AI key performance indicators. DOD concurred with all seven recommendations, but has not yet completed actions to implement them.

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## DOD AI Strategies

DOD has released several strategies that outline its broader approach, education plan, and responsibilities for AI. These strategies include the following:

- In February 2019, DOD issued a summary of the 2018 *DOD AI Strategy*, which directed DOD to accelerate the adoption of AI and emphasized that a strong, technologically advanced department was essential for protecting the security of the nation.<sup>22</sup> This strategy includes initiatives such as cultivating a leading AI workforce and leading in military ethics and AI safety. According to an official from the Office of the Under Secretary of Defense for Acquisition and Sustainment, DOD plans to publicly release a Data, Analytics, and AI Strategy in the spring of 2023, following the release of the 2022 National Defense Strategy.
- In 2020, the Joint AI Center published the *DOD AI Education Strategy*, which focused on modernizing DOD with an AI-ready workforce that will be able to quickly adopt AI.<sup>23</sup> The Joint AI Center developed this strategy to address several concerns, such as DOD's obstacles to hiring large numbers of AI experts and its lack of AI-ready infrastructure spread across a wide range of missions.

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<sup>21</sup>GAO, *Artificial Intelligence: DOD Should Improve Strategies, Inventory Process, and Collaboration Guidance*, [GAO-22-105834](#) (Washington, D.C.: Mar. 30, 2022).

<sup>22</sup>The 2018 *DOD AI Strategy* is an annex to the 2018 *National Defense Strategy*, which underpins DOD's planned budgets for fiscal years 2019 through 2023, including accelerating modernization programs such as AI-related applications. The summary of the *National Defense Strategy* states that, "The Department will invest broadly in military application of autonomy, artificial intelligence, and machine learning, including rapid application of commercial breakthroughs, to gain competitive military advantages."

<sup>23</sup>Department of Defense, *2020 DOD Artificial Intelligence Education Strategy* (2020).

- In February 2020, the department released its *Ethical Principles for AI*, which apply to both warfighting and non-warfighting AI capabilities.<sup>24</sup> According to this guidance, the department was committed to AI that incorporates five ethical principles: responsible, equitable, traceable, reliable, and governable.
- In May 2021, the Deputy Secretary of Defense issued a memorandum that established and directed the department's approach to responsible AI. The Deputy Secretary of Defense then published the *Responsible Artificial Intelligence Strategy and Implementation Pathway* in June 2022, which called for the Chief Digital and AI Officer, among others, to develop tools and guidance to synchronize responsible AI implementation for the department across the acquisition life cycle.<sup>25</sup> This strategy is organized around six lines of effort, such as modernizing governance structures and processes that allow for continuous oversight of DOD use of AI, among others.<sup>26</sup>

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## Company Representatives Identified a Variety of Key Factors They Consider when Acquiring AI Capabilities

Representatives from the 13 companies with AI expertise across various business sectors that we reviewed identified numerous key factors garnered from their experiences in acquiring AI capabilities and managing them throughout the AI life cycle. Based on our analysis of the data collected from these representatives, we identified 31 unique factors that companies consider. We generally grouped these factors into five categories, shown in figure 4. For the complete list of factors identified from our analysis, see appendix III.

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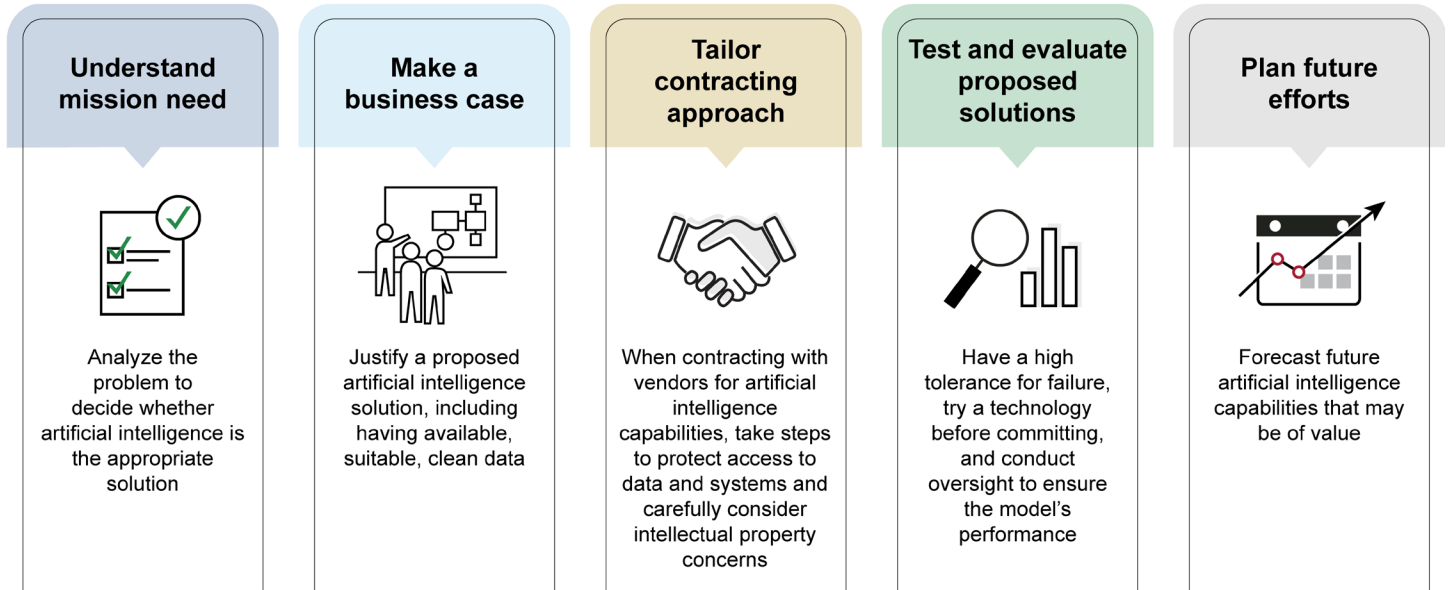
<sup>24</sup>Department of Defense, *DOD Adopts Ethical Principles for Artificial Intelligence* (Feb. 24, 2020), accessed March 23, 2023, <https://www.defense.gov/News/Releases/Release/Article/2091996/dod-adopts-ethical-principles-for-artificial-intelligence/>.

<sup>25</sup>Department of Defense, *Responsible Artificial Intelligence Strategy and Implementation Pathway* (June 2022).

<sup>26</sup>DOD, *Responsible Artificial Intelligence Strategy and Implementation Pathway*.



Figure 4: Categories of Factors Selected Companies Reported Considering when Acquiring Artificial Intelligence Capabilities



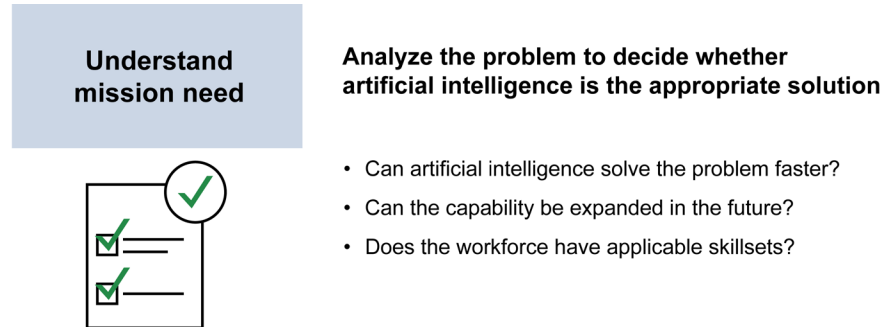
Source: GAO analysis of private sector information; GAO (icons). | GAO-23-105850

Each of these categories and several of the factors within them are also reflected in our *AI Accountability Framework*.<sup>27</sup> See figures 5-9 below for a depiction of each of the five categories and a summary of the factors within each. Below each figure, we discuss a few corresponding examples from our discussions with representatives from private sector companies.

<sup>27</sup>GAO-21-519SP.

## Applying AI to Meet Specific Mission Needs

**Figure 5: Key Factors Related to Understanding Mission Need**



Source: GAO analysis of private sector information, GAO (icon). | GAO-23-105850

- **Can AI solve the problem faster?** Representatives from each of the 13 companies we contacted described various mission needs and requirements that led them to conclude AI was an appropriate solution for a specific task or purpose. Representatives from several companies told us that they consider whether AI could be appropriate given the specific business or organizational problem the AI is meant to address. For example, representatives from one defense company told us that AI-enabled systems can relieve the burden of “dull, dirty, and dangerous” tasks like monitoring cameras, watching the skies for enemy drones, examining imagery, certain forms of signal processing, and more. Another company’s representatives noted that AI helps them identify acute pathologies in CT scans, such as strokes or brain bleeds, to alert physicians to facilitate faster care for time-critical findings. Representatives from two banking companies told us that they use AI to extract large amounts of loan data to facilitate quicker analysis or to examine vast amounts of transaction data to detect fraudulent activity. Our *AI Accountability Framework* notes that it is important to define clear goals and objectives for the AI system to ensure its intended outcomes are achieved.<sup>28</sup> Further, it states that an entity should assess whether outputs are appropriate for the operational context in which the AI system is being used. Company representatives noted several examples where the use of an AI solution would not be appropriate, such as when only a small quantity of data needs to be analyzed, or might not be appropriate absent a human oversight mechanism, such as when the problem requires making human or moral decisions about a course of action.

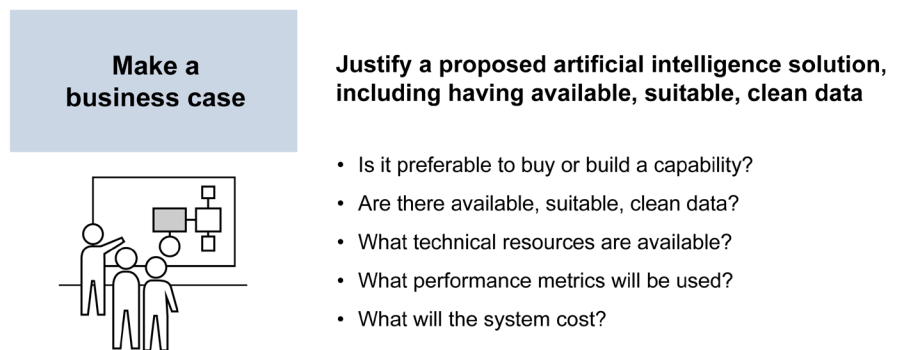
<sup>28</sup>[GAO-21-519SP](#).

Representatives from one company noted that AI could be used to more rapidly and effectively detect and confirm a potential threat, while a “human on the loop” would then confirm and enable the response.

- **Can the capability be expanded in the future?** Representatives from several companies noted they look to pursue systems where a capability could have an initial valuable contribution and also be expanded over time, such as when security threats change or one banking company’s document processing solution that can work in additional business areas.
- **Does the workforce have applicable skillsets?** Lastly, company representatives told us they consider the skillsets the workforce has to broadly work with AI systems, when assessing whether to pursue an AI solution. For example, one company’s representatives noted that it is important to have talent that can take the steps to clean the data—i.e., prepare the data to make them usable—where possible and analyze them in a way that includes proper controls to address their limitations, such as potential biases.

## Developing Business Cases for Using AI

**Figure 6: Key Factors Related to Making a Business Case**



Source: GAO analysis of private sector information, GAO (icon). | GAO-23-105850

- **Is it preferable to buy or build a capability?** Company representatives we spoke with described several factors that they consider when determining whether to build their own internal AI solution or pursue a commercially available solution.<sup>29</sup> This can be described as developing a sound business case for the solution,

<sup>29</sup>Of the 13 companies we contacted, three told us they build their AI capabilities in-house and do not procure AI from commercial vendors.

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which requires balance between the concept selected to satisfy operator needs and the resources—knowledge, funding, and time—needed to transform the concept into a product. For example, some representatives noted they may prefer to build their own solution if a commercial solution is not readily available or if they want to create or maintain a competitive advantage. Alternatively, companies might opt to pursue a commercial solution if one is readily available, or is expected to be less expensive or faster to obtain. One company's representatives noted that, as part of the decision to build versus buy, it is important to clearly define responsibility for ongoing monitoring, maintenance, improvement, and delivery. If a third party is responsible, it is paramount to make sure it has the necessary experience and resources. If the buying company is responsible, it is important to plan the handover of the training and evaluation infrastructure and data so that AI models can be further maintained by the buyer.

- **Are there available, suitable, clean data?** Most company representatives we spoke with generally noted that having available, suitable, and adequately clean data as a key input to an AI model—where the type of data may define the need for a particular type of AI technology—is critical for the success of the model. For example, representatives from one company told us that a lack of unified policies for data sharing and data governance frequently results in inconsistent data availability and usability. Since developing and using AI requires substantial amounts of data, these obstacles can represent a significant impediment to AI adoption. We previously reported that DOD faces a lack of available, usable data, such as accurately labeled historical data, among other challenges.<sup>30</sup> Our *AI Accountability Framework* also notes that, when developing an AI model, entities should document origins and sources of data, ensure the data's reliability, and assess the data's attributes, variability, and to what extent they have been enhanced or augmented to ensure that they are appropriate for the intended use.<sup>31</sup>
- **What technical resources are available?** Representatives from several companies noted that they consider their available technical resources when integrating AI capabilities into their existing physical infrastructure. For example, representatives from one company noted that understanding the system the AI will be integrated with will inform the hardware specifications that must be met and how much memory

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<sup>30</sup>[GAO-22-104765](#).

<sup>31</sup>[GAO-21-519SP](#).

space is required. Additionally, according to representatives from another company, computer processing capabilities are another important consideration. We previously reported that DOD faces difficulties integrating trained AI into existing weapon systems that were not initially designed for it.<sup>32</sup> As such, the ability of buyers to use and understand a capability that requires these infrastructure-related resources are important factors of the business case.

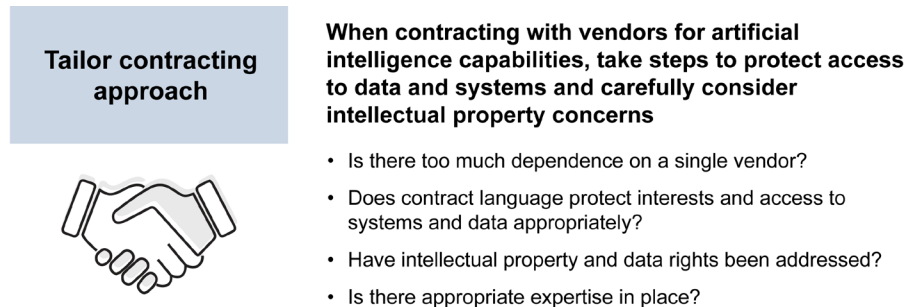
- **What performance metrics will be used?** Several company representatives recommended considering any AI-specific requirements and performance metrics. Representatives from one company told us that identifying performance metrics is dependent on factors such as the AI use case, the importance of the task, and the overarching business objectives. Frequently used metrics could include those to measure the ability to explain an AI algorithm, the degree of an algorithm's bias, representativeness of training and test data, and performance against quantified risk management standards established by the buyer or vendor, among other things. Another critical performance metric, according to these representatives, is how productive an AI capability is in delivering predictions and outputs relative to the existing practices the capability is replacing.
- **What will the system cost?** Some company representatives also discussed the importance of having an adequate understanding of the estimated cost of building or buying the AI capability. In particular, for an AI capability, company representatives told us that costs for data computation, which can be significant, should be factored into the cost estimate. One company's representatives told us that the main distinction between AI and traditional software is that AI has compute costs that greatly overshadow the cost of storage, as compute power is extremely expensive. They noted that one potential approach for reducing compute costs is to use a digital AI platform, which would also include tools that reduce the need for specialized expertise and thus reduce potentially high personnel costs as well. Representatives from several companies also described purchasing certain types of necessary AI capability on a "software-as-a-service" or subscription basis, and said that such models provide more flexibility to scale the capability up or down or to replace it with another when it becomes clear that one technology is outpacing another.

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<sup>32</sup>[GAO-22-104765](#).

## Tailoring Contracting Approaches for AI

**Figure 7: Key Factors Related to Tailoring Contracting Approach**



Source: GAO analysis of private sector information; GAO (icon). | GAO-23-105850

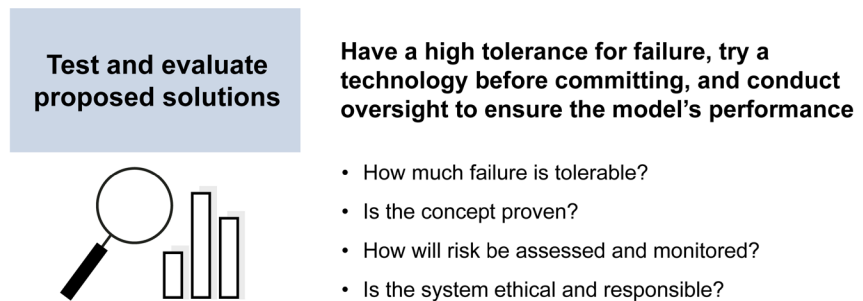
- **Is there too much dependence on a single vendor?** Representatives from several companies noted that it is important to create strategies to avoid “vendor lock-in,” or dependence on a single supplier. For example, they suggested holding regular competitions for a particular service, maintaining alternative vendors to the extent possible, and limiting the use of proprietary software. Specifically, representatives from one company told us that to avoid vendor lock-in, they ensure there is at least one other alternative vendor capable of providing any AI solution they pursue. They stated that they are very cautious not to select an AI capability that only works on a single cloud infrastructure to avoid being locked into that vendor’s infrastructure.
- **Does contract language protect interests and access to systems and data appropriately?** Company representatives also recommended including specific contract language in AI acquisitions. For example, representatives of four of the 13 companies we contacted told us that they include specific contract language such as “escrow clauses” to ensure access to the AI model’s source code if the vendor goes bankrupt.
- **Have intellectual property and data rights concerns been addressed?** Representatives from several companies noted that it is important to carefully consider a vendor’s intellectual property and that handling such concerns should be done on a case-by-case basis as each vendor and each AI solution is unique. In addition, purchasing AI systems should take into account data rights, and, according to representatives from one company, ownership of data is complicated and the legal staff should be equipped to address these matters. Additionally, another company’s representatives noted that the use of alternative contract structures, such as subscription-based structures,

is often useful to address intellectual property concerns, as well as to facilitate rapid AI procurement. Our *AI Accountability Framework* adds that in the case of entities procuring AI systems from vendors, contracts should include provisions for appropriate access to data, models, and parameters to enable sufficient oversight and auditing.<sup>33</sup>

- **Is the appropriate expertise in place?** Lastly, representatives from several companies discussed the need to involve cross-functional or multidisciplinary teams—including subject matter experts from business, finance, legal, and relevant technical disciplines such as data scientists—in the buying process. Representatives from one company told us that there is often a need for more than one type of expert to provide guidance to buyers of AI, such as privacy experts to ensure that personal information is obscured and the system works in an ethical manner, among others. Another stated that requirements should be developed through cross-organizational stakeholder engagement and brainstorming, to identify potential use cases and ensure that the specific organizational needs and constraints, as well as relevant regulations and guidance, are considered. The *AI Accountability Framework* also encourages users to obtain diverse perspectives from a community of stakeholders throughout the AI life cycle to mitigate risks.<sup>34</sup>

## Building in Testing and Evaluation of AI Solutions

**Figure 8: Key Factors Related to Testing and Evaluation of Proposed Solutions**



Source: GAO analysis of private sector information; GAO (icon). | GAO-23-105850

- **How much failure is tolerable?** Representatives from several companies we spoke with discussed the need to have a high tolerance for failure, meaning to accept that some solutions will

<sup>33</sup>[GAO-21-519SP](#).

<sup>34</sup>[GAO-21-519SP](#).

naturally fail or not deliver the desired result. In these instances where failure is unavoidable, they noted that it is preferable to fail quickly (i.e., before significant funds have been invested) in order to quickly move on to another possible solution.

- **Is the concept proven?** According to representatives from some companies, requiring vendors to demonstrate a proof of concept before committing to a solution is another method to limit overly investing in an unproven solution. For example, representatives from one company told us that proofs of concept are important to helping a prospective buyer budget for the AI capability as it gives an understanding of what the AI capability might be able to do and how much of it they might need moving forward. Additionally, two companies' representatives noted that they do not always initially share the performance metrics with vendors during the proof of concept stage; rather, they have company experts examine the test results independently.
- **How will risk be assessed and monitored?** Performing risk assessments as part of the acquisition to identify limitations in building or buying a new product is also advisable, according to several companies' representatives. Another noted that when planning testing during the acquisition process, managers should consider cost and effort involved in retraining an algorithm due to drift (i.e., when AI predictions become less reliable over time because data inputs encountered by the algorithm differ from the original training data). These representatives said post-deployment testing of the model is useful to preserve accuracy and that buyers may periodically consider whether a capability continues to be cost effective and productive, and under what performance and risk conditions retirement should be considered.
- **Is the system ethical and responsible?** Representatives from several companies we spoke with also emphasized understanding the responsible AI and ethical considerations necessary to implement a system. For example, representatives from one company told us that limited explanation of a system's algorithms introduces difficult ethical, accountability, and bias considerations; thus, algorithms that cannot be fully explained may not be appropriate for sensitive business problems and use cases. However, representatives from another company said that for certain business functions, such as for a human resources function, as long as the technology is proven and privacy concerns are addressed, more limited explanations can be acceptable. Representatives from a third company noted that in regard to automation bias—the over-reliance on and over-acceptance

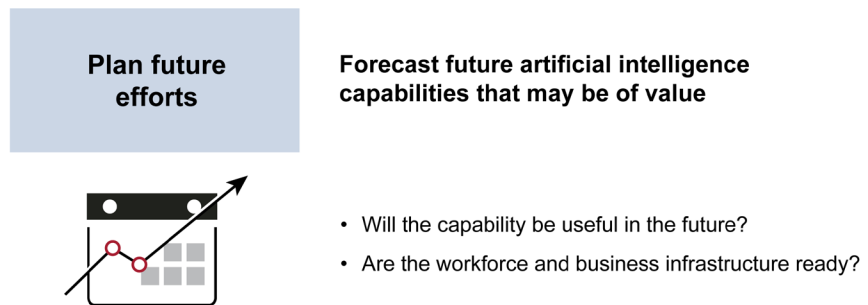


of suggestions from systems that are automated—raising awareness of the potential bias among users of the capability may lead to better outcomes as the user may pause to consider whether they trust the machine more than their own judgement. Additionally, these representatives noted that it is incumbent on users of AI to ensure that there is a human oversight mechanism to continuously monitor the ethical considerations of a capability.

Our *AI Accountability Framework* also notes the need to pay particular attention to ethical considerations when monitoring a system’s performance.<sup>35</sup> Specifically, the framework notes that entities should identify potential biases and develop procedures for human supervision of the AI system. This helps ensure the system will produce results that are consistent with the intended program objectives. Additionally, the framework notes that when determining performance metrics, a program manager should consider the extent to which the metrics are consistent with system goals, objectives, and constraints, including ethical considerations.

## Planning for Initial AI Uses with Eye on Future Improvements

**Figure 9: Key Factors Related to Planning Future Efforts**



Source: GAO analysis of private sector information, GAO (icon). | GAO-23-105850

- **Will the capability be useful in the future?** Representatives from each of the companies we spoke with told us that they work to consider how AI can be integrated into future systems and its adaptability by considering potential future use cases. Several further noted that, when looking into AI solutions, they prefer to invest in adaptable solutions that maximize interoperability. This enables companies to adapt the systems to future use cases without having to

<sup>35</sup>[GAO-21-519SP](#).

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make significant new investments. For example, representatives from one company told us that they build modular systems that can be expanded to add future capabilities and emphasized that they look for configurable solutions to fit these systems. The *AI Accountability Framework* echoes that entities should identify conditions under which the AI system may be scaled or expanded beyond its current use.<sup>36</sup>

- **Are the workforce and business infrastructure ready?** In addition, representatives from companies we spoke with discussed the need to have a business culture that is supportive of AI, including a clear understanding by leadership of the purpose and potential uses of AI and enterprise-wide readiness for it through acceptance and corresponding business infrastructure. This includes implementing AI and capability-specific training for users, leadership, and talent managers. For example, one company's representatives told us their frameworks are designed to assist procurement staff with non-technical considerations of how prospective AI solutions integrate with existing business processes. Similarly, the *AI Accountability Framework* notes the need for a competent workforce, specifically one with multidisciplinary skills and experiences in design, development, deployment, assessment, and monitoring of AI systems.<sup>37</sup>

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## DOD Has Not Issued Department-Wide Guidance for AI Acquisitions, Though Aspects of Company Key Factors Are Reflected in Some Resources

Although numerous DOD components are acquiring, developing, or already using AI, DOD has not issued comprehensive department-wide guidance for AI acquisitions. Similarly, the military services have not issued service-specific guidance that is tailored to their individual needs. This lack of guidance could result in acquisition of AI capabilities across the services that does not consistently address the unique challenges associated with AI or the specific needs of the acquiring service. To fill this gap, various military services and other DOD components have individually developed or plan to develop their own informal AI acquisition

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<sup>36</sup>[GAO-21-519SP](#).

<sup>37</sup>[GAO-21-519SP](#).

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resources. Some of these DOD component resources reflect key factors also identified by the selected companies for AI acquisitions.

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## DOD Has Not Issued Department-Wide AI Acquisition Guidance

Currently, there is no comprehensive, DOD-wide guidance specific to AI acquisitions. In addition, the department has not updated existing acquisition guidance to account for the emergence of AI acquisitions. According to many officials from the DOD components that we interviewed, authoritative AI acquisition guidance would be helpful to navigate the AI acquisition process.

According to an official from the Office of the Under Secretary of Defense for Acquisition and Sustainment, the standing up of the Office of the Chief Digital and AI Officer paused the development of department-wide AI acquisition guidance until the Chief Digital and AI Officer has a clear plan for concentrating their efforts. We reported in February 2022 that the Office of the Under Secretary of Defense for Acquisition and Sustainment was working to adjust the Software Acquisition Pathway for AI and issue updated guidance to DOD components as it becomes available.<sup>38</sup> This guidance has not been issued as of December 2022. Officials from that office stated that they are now working in collaboration with the Office of the Chief Digital and AI Officer to develop this guidance, which will be incorporated into Adaptive Acquisition Framework best practices specific to AI projects. The Office of the Chief Digital and AI Officer is also in the process of planning to develop AI acquisition guidance and standing up an acquisition policy office to do so, but has not yet defined concrete plans.<sup>39</sup> An official from that office stated that there is no timeline for this effort.

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<sup>38</sup>[GAO-22-104765](#).

<sup>39</sup>The AI in Government Act of 2020 required the Office of Management and Budget to establish guidance that would inform agencies' guidance on acquisition and use of AI. Consolidated Appropriations Act, 2021, Pub. L. No. 116-260, Div. U. Title I, §104, 134 Stat. 2288-89 (Dec. 27, 2020). We have ongoing work looking at whether agencies, including the Office of Management and Budget, have fulfilled requirements related to AI, but as of March 2023, the Office of Management and Budget has not issued any guidance. According to an official from the Office of the Chief Digital and AI Officer, the Office of the Under Secretary of Defense for Acquisition and Sustainment has requested that the Chief Digital and AI Officer develop AI-specific guidance, but they do not yet have a specific timeline for this effort.

The Deputy Secretary of Defense stated in the February 2022 memorandum that the Chief Digital and AI Officer will lead and oversee DOD's strategy development and policy formulation for data, analytics, and AI. Further, this memorandum states that the Chief Digital and AI Officer is responsible for creating an enabling digital infrastructure and services that support components' development and deployment of data, analytics, AI, and digital-enabled solutions. In addition, our *AI Accountability Framework* includes governance as a main principle, stating that entities should promote accountability by establishing processes to manage, operate, and oversee implementation of AI. This principle also includes having clear goals, as well as defined roles and responsibilities.<sup>40</sup>

Until DOD establishes department-wide guidance to act as a framework, it cannot ensure that its components are acquiring AI capabilities in a manner that accounts for the unique challenges and considerations associated with AI as they navigate the acquisition process. Additionally, given that DOD is investing considerable effort and funds toward developing and acquiring AI tools and capabilities and requested \$1.1 billion for core AI in fiscal year 2023, establishing guidance would better position DOD to effectively spend funds on AI acquisitions consistently across its components. This guidance could, as appropriate, leverage key private company observations identified earlier.

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### The Military Services Have Not Issued Service-Specific AI Acquisition Guidance

In the absence of department-wide guidance, the military services have not issued service-specific implementing guidance tailored to their unique needs. Officials from each of the military services told us that they fill these gaps through their own or other services' resources:

- An official from the Army told us that DOD-wide guidance would be helpful to streamline the AI acquisition process. An Army official shared that DOD-wide or service-level guidance for AI acquisition that clearly lays out the steps to add an AI capability to a platform or mission would be useful. This official stated that in lieu of such guidance, Army commands can approach procurement as they see fit,

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<sup>40</sup>[GAO-21-519SP](#).

which can create challenges when fitting AI into existing acquisition pathways.

- A Navy official told us that the Chief Digital and AI Officer has been helpful in promoting engagement with AI capabilities, but that they do not depend on support from this office. Marine Corps officials stated that DOD guidance would be helpful for the AI acquisition process and explained that having headquarters-level AI acquisition guidance standards is critical to get ahead of this new technology. In the absence of such guidance, these officials told us that they look to other military departments and their work, as they benefit from others' lessons learned.
- According to Air Force officials, because of these gaps in guidance, the Air Force-Massachusetts Institute of Technology AI Accelerator developed its own guidebook with subject matter experts to compile lessons learned.<sup>41</sup> Space Force officials told us that they leverage Air Force resources and do not have their own guidance or resources.

Our prior work in weapon systems cybersecurity, another emerging technology area, found that while departmental policies and guidance set broad expectations for acquisition practices and objectives, service-level implementing guidance was also important to provide more detail tailored to the types of systems each service acquires.<sup>42</sup> We reported that while DOD policies broadly define weapon systems acquisition practices and objectives for cybersecurity, the services have a role in developing and issuing complementary guidance, as needed, for implementation within their service acquisition community.<sup>43</sup> We also stated that the timing of service-level guidance is significant because some service acquisition officials reported implementing DOD guidance only after receiving the service level instructions and guidance. Guidance tailored to the types of capabilities each service acquires could include, for example, a decision-support AI capability to help operators plan and execute Navy undersea warfare missions, or a target-detection capability using satellite imagery.

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<sup>41</sup>Department of the Air Force-Massachusetts Institute of Technology AI Accelerator, *Artificial Intelligence Acquisition Guidebook* (Cambridge, MA: Feb. 14, 2022).

<sup>42</sup>GAO, *Weapon Systems Cybersecurity: Guidance Would Help DOD Programs Better Communicate Requirements to Contractors*, [GAO-21-179](#) (Washington, D.C.: Mar. 4, 2021).

<sup>43</sup>[GAO-21-179](#).

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Service-specific guidance would better position each service to acquire AI capabilities in a manner that incorporates and balances department priorities with service-specific needs. This service-level guidance could, as appropriate, leverage key private company observations identified earlier. *Our AI Accountability Framework* states as part of its governance principle that entities should promote accountability by establishing processes to manage, operate, and oversee implementation of AI, as well as have clear goals.<sup>44</sup>

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### Various DOD Components Created Informal AI Acquisition Resources, Some of Which Reflect Key Factors for Acquiring AI Selected Companies Identified

While DOD and the military services have not issued guidance on AI acquisitions, some DOD components have developed informal AI acquisition-related resources that can assist their approach to AI acquisitions. Some of these resources created by DOD components incorporate the key factors identified by companies from the five broad categories we previously discussed (see appendix III for a full list of categories and factors for this analysis). These resources, which are informal and internal documents that may assist components in their work as defined above, do not constitute guidance that establishes component-wide policy. For example, at the Office of the Secretary of Defense level, the Office of the Chief Digital and AI Officer has developed various resources for AI acquisitions. In particular, Tradewind—the AI acquisition marketplace for users—provides the Tradewind AI Projects User Guide, which includes a process to help DOD personnel understand their problem statement, the capability needs, and the context of the issue. The Chief Digital and AI Officer also gives Tradewind users access to resources such as the Intellectual Property and Data Rights Related Customer Questions for Project Planning, and Tradewind Request for Discussion and Initial Proposal Template to help others plan their AI projects, proposals, capabilities, and developments.

Officials from the Office of the Chief Digital and AI Officer told us that they made some of their resources related to various aspects of AI acquisition available to other DOD components. According to officials from the Office of the Under Secretary of Defense for Acquisition and Sustainment, they

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<sup>44</sup>[GAO-21-519SP](#).

are partnering with a private consulting company to build a catalog of Chief Digital and AI Officer acquisition services.

The Defense Innovation Unit created several AI worksheets that walk developers through questions to help them align their AI projects with DOD's ethical AI principles. Officials from the Defense Innovation Unit told us that when DOD released its ethical AI principles in 2020, they received numerous questions from vendors on how to align their proposals. This led the Defense Innovation Unit to seek feedback from industry, academia, and government, which influenced the development of these worksheets.<sup>45</sup>

Of the five military services, the Air Force has published AI-specific acquisition resources—specifically, the Air Force-Massachusetts Institute of Technology *AI Acquisition Guidebook*.<sup>46</sup> Air Force officials called the guidebook an acquisition resource that they developed based on internal subject matter expertise to address a gap in AI acquisition guidance and resources. These officials described the guidebook as a living document, which they will continue to update so that it has the most relevant information. Air Force officials told us they shared this guidebook through their available channels, including online and to the acquisition community, and have briefed it to the highest levels of the department.

Our review of these resources indicates that several of them contain elements of the five categories of factors selected private companies reported considering when acquiring AI. For example, the private companies we reviewed noted that it was important to *Tailor Contracting Approach* when acquiring AI. Consistent with this factor, several Tradewind resources emphasize the need to consider intellectual property and data rights concerns when negotiating contracts for AI. Similarly, the Defense Innovation Unit Worksheets include a discussion on the importance of providing for access to data in contract language. Lastly, the Air Force Acquisition Guidebook notes the importance of creating a diverse integrated product team when developing a contracting strategy.

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<sup>45</sup>Defense Innovation Unit, *Phase I: Planning Worksheet for DIU AI Guidelines* (Washington, D.C.).

<sup>46</sup>Department of the Air Force-Massachusetts Institute of Technology AI Accelerator, *Artificial Intelligence Acquisition Guidebook*.

Several DOD components discussed their plans for developing additional resources for AI. They said that these resources should assist components in AI acquisitions, but the resources will not constitute formal department-wide guidance. For example, officials from the Office of the Chief Digital and AI Officer told us that, among other initiatives, they are planning to publish lessons learned in Tradewind, which will focus on how to acquire AI using available acquisition pathways. Officials from the Intellectual Property Cadre shared their plans to publish an Intellectual Property Guidebook that will be applicable, but not specific, to AI acquisitions.<sup>47</sup> Defense Acquisition University officials told us that they plan to provide commercial AI training to their own acquisition workforce, including plans to develop several AI-focused courses on AI reliability and system safety. Air Force officials told us they plan to add a course for acquisition personnel on building and designing AI applications, as well as a class for field grade officers and senior noncommissioned officers. Officials from the Navy also shared their plans to create the Naval AI Accelerator, a training and education Center of Excellence.

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## Conclusions

Because of the opportunities AI presents, efforts to acquire AI tools or integrate AI into DOD weapon systems are poised for rapid growth—growth that could outpace DOD’s efforts to develop appropriate and sufficiently broad guidance for those acquisitions. AI offers the potential for broad application across the military services and joint acquisition programs to significantly enhance capabilities available to the warfighter. However, DOD has not issued department-wide guidance to provide a

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<sup>47</sup>The Intellectual Property Cadre leads a coordinated DOD-wide effort to modernize intellectual property policies, culture, and best practices to maximize the return on DOD technology investments, reduce program sustainment costs, and better enable the delivery of cutting-edge technology advantage to the warfighter at scale, faster. According to the cadre, in cases when AI vendors are concerned about protecting their intellectual property from competitors or third parties, the need to adapt their customary practices to meet certain DOD software requirements may be a disincentive to partner with DOD. To better incentivize AI vendors to collaborate with DOD, cadre officials noted that DOD buyers should develop acquisition strategies that seek to align their requirements with AI vendor business models. For example, according to the cadre, for agreements or instruments other than procurement contracts, such as Other Transaction agreements, the Defense Federal Acquisition Regulation Supplement data rights rules do not apply, and the parties generally have even greater flexibility to negotiate specialized or tailored license agreements.



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framework to ensure that acquisition of AI is consistent across the department and accounts for the unique challenges associated with AI.

It is especially important that DOD and the military services issue guidance to provide critical oversight, resources, and provisions for acquiring AI given that the U.S. will face AI-enabled adversaries in the future. Without such guidance, DOD is at risk of expending funds on AI technologies that do not consistently address the unique challenges associated with AI and are not tailored to each service's specific needs. The private company observations previously discussed offer numerous considerations DOD may wish to leverage in guidance, as appropriate, as it continues to pursue AI-enabled capabilities.

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## Recommendations for Executive Action

We are making a total of four recommendations, including one to DOD, one to the Army, one to the Navy, and one to the Air Force.

The Secretary of Defense should ensure that the Chief Digital and AI Officer, in conjunction with other DOD acquisition policy offices as appropriate, prioritize establishing department-wide AI acquisition guidance, including leveraging key private company factors, as appropriate. (Recommendation 1)

After DOD issues department-wide AI acquisition guidance, the Secretary of the Army should establish service-specific AI acquisition guidance that includes oversight processes and clear goals for these acquisitions, and leverages key private company factors, as appropriate. (Recommendation 2)

After DOD issues department-wide AI acquisition guidance, the Secretary of the Navy should establish service-specific AI acquisition guidance that includes oversight processes and clear goals for these acquisitions, and leverages key private company factors, as appropriate. (Recommendation 3)

After DOD issues department-wide AI acquisition guidance, the Secretary of the Air Force should establish service-specific AI acquisition guidance that includes oversight processes and clear goals for these acquisitions, and leverages key private company factors, as appropriate. (Recommendation 4)

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## Agency Comments

We provided a draft of this report to DOD for review and comment. DOD's response is reproduced in appendix IV. Subsequently, an official from the Office of the Under Secretary of Defense for Acquisition and Sustainment confirmed via email that DOD concurred with all four recommendations.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense, the Under Secretary of Defense for Acquisition and Sustainment, and the Chief Digital and AI Officer. In addition, the report is available at no charge on GAO's website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact Jon Ludwigson at (202) 512-4841 or [ludwigsonj@gao.gov](mailto:ludwigsonj@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.



Jon Ludwigson  
Director, Contracting and National Security Acquisitions

## Appendix I: Objectives, Scope, and Methodology

The Senate Report accompanying a bill authorizing fiscal year 2021 appropriations includes a provision for GAO to review the Department of Defense's (DOD) artificial intelligence (AI) acquisition-related efforts.<sup>1</sup> This report examines (1) the key factors that selected private sector companies reported considering when acquiring AI capabilities, and (2) the extent to which DOD's AI acquisition guidance, if any, reflects key factors identified by private sector companies.

To conduct our work, we conducted outreach to, interviews with, or obtained written responses from the following organizations:

- Office of the Secretary of Defense organizations and other key DOD entities: Office of the Chief Digital and AI Officer; Office of the Under Secretary of Defense for Acquisition and Sustainment; Defense Pricing and Contracting; the Intellectual Property Cadre; Defense Acquisition University; and Defense Innovation Unit.
- Military service entities: Army AI Integration Center; Office of the Deputy Assistant Secretary of the Army (Procurement); Department of the Air Force Chief Data and AI Office; Office of the Assistant Secretary of the Air Force (Acquisition, Technology, and Logistics); Department of the Air Force-Massachusetts Institute of Technology AI Accelerator; Air Force Office of the Deputy Assistant Secretary (Contracting); Office of the Chief of Naval Operations; Office of the Assistant Secretary of the Navy (Research, Development and Acquisition); Marine Corps Systems Command; and Office of the Assistant Secretary of the Air Force for Space Acquisition and Integration.

To identify the key factors that selected private sector companies reported considering when acquiring AI capabilities, we conducted semi-structured interviews with or requested written responses to the same semi-structured questions from senior management and other representatives knowledgeable about AI procurement from leading

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<sup>1</sup>S. Rep. No. 116-236, at 131 (2020).

companies across a variety of business sectors.<sup>2</sup> We selected these companies by compiling a list of publicly identified AI companies across a variety of sectors, in consultation with our internal subject matter experts.

We contacted each of the companies on the list, and of those, conducted oral interviews with a smaller nongeneralizable sample based on sector and availability. These 13 companies included the following:

- Amazon; Amgen Inc.; Anduril Industries; Bank of America; Deloitte Consulting LLP; Google Cloud; Johnson & Johnson; PNC Financial Services Group, Inc.; Scale; Tamr; Uber Technologies Inc; U.S. Bank; and Viz.ai, Inc.

With representatives from each of these 13 companies, we discussed (1) buying versus building AI in-house, (2) procuring and developing AI capabilities, and (3) risk tolerance, funding, and long-term planning. We conducted a content analysis, using the oral and written responses received from the companies. The primary component of this analysis was coding of the responses and documentation to identify common themes, which we defined as topics or concepts discussed by five or more companies. We then grouped similar themes to establish the five key areas of consideration and associated examples discussed in the report. To validate our data collection, we shared the company summaries with company representatives, solicited their feedback, and, to the extent possible, confirmed their agreement with how we characterized their responses.

To analyze the extent to which DOD's approach to AI acquisition incorporates key factors identified by companies, we reviewed DOD documentation and AI acquisition resources, which for the purposes of this report refer to user manuals, guidebooks, and trainings. We obtained this documentation and resources based on any such information identified in interviews with relevant DOD officials. These acquisition resources included DOD's AI acquisition marketplace (Tradewind) and the U.S. Air Force-Massachusetts Institute of Technology AI Accelerator *AI Acquisition Guidebook*, among others. We also reviewed information and documentation provided by the Defense Innovation Unit and Defense Acquisition University. We compared these documents to the key

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<sup>2</sup>We requested responses from approximately 90 companies. We received written responses from six companies and conducted interviews with seven companies based on sector and availability.

considerations identified by the selected companies by searching each document for each key consideration.

We also interviewed relevant officials from the Office of the Chief Digital and AI Officer, Office of the Under Secretary of Defense for Acquisition and Sustainment, Defense Pricing and Contracting, the Intellectual Property Cadre, and the military services to discuss these resources and documents and identify any key areas of consideration for these DOD components.

We conducted this performance audit from February 2022 to June 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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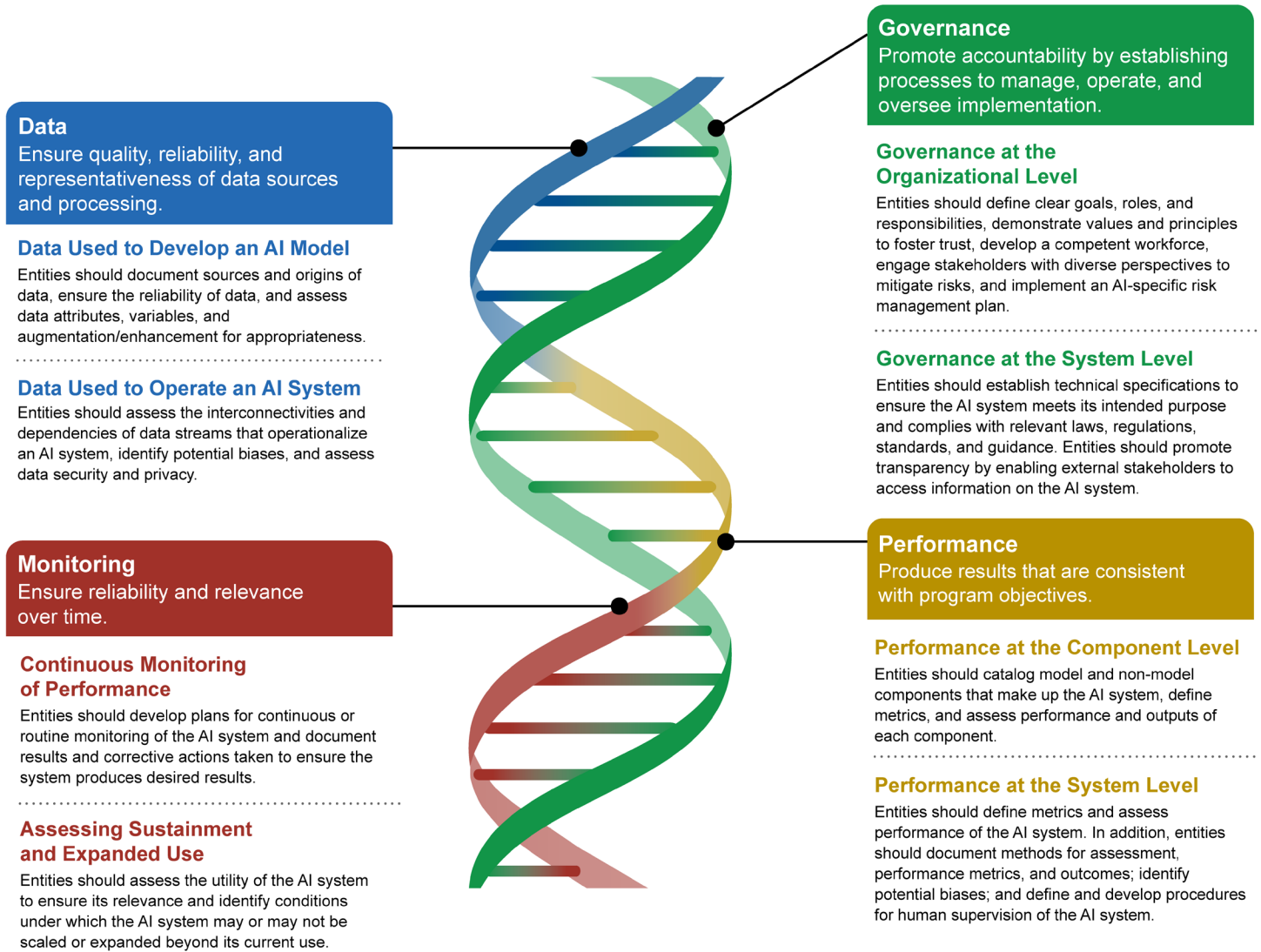
## Appendix II: Overview of GAO's Artificial Intelligence Accountability Framework

In June 2021, we published an artificial intelligence (AI) accountability framework that identifies key practices to help ensure accountability and responsible use of AI by federal agencies and other entities involved in the design, development, deployment, and continuous monitoring of AI systems.<sup>1</sup> The framework is organized around four complementary principles addressing governance, data, performance, and monitoring. For each principle, the framework describes key practices for federal agencies and other entities that are considering, selecting, and implementing AI systems. Each practice includes a set of questions for entities, auditors, and third-party assessors to consider, as well as procedures for auditors and third-party assessors. Figure 10 illustrates the key points of each principle.

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<sup>1</sup>GAO, *Artificial Intelligence: An Accountability Framework for Federal Agencies and Other Entities*, [GAO-21-519SP](#) (Washington, D.C.: June 2021).

Figure 10: Artificial Intelligence (AI) Accountability Framework



Source: GAO. | GAO-23-105850

# Appendix III: Key Factors Selected Companies Reported Considering When Acquiring and Managing Artificial Intelligence

**Table 1: Key Factors and Subfactors Considered by Companies in GAO’s Review Related to Artificial Intelligence (AI) Capability Acquisitions and Management**

**Understand Mission Need:** analyze the problem to decide whether AI is the appropriate solution, such as determining the problem can be solved at a higher speed using AI.

- Solving the problem with data or automation, including having a large volume of data necessary for AI training
- Having applicable available skillsets among developers and users
- Solving the problem at a higher speed with AI
- Considering if AI is appropriate given the business or organizational problem the AI is meant to address and the intended consumer
- Starting with a narrowly-defined need and building out over time/scalability of a capability

**Make a Business Case:** justify a proposed AI solution, including having available, suitable, clean data as a key input in the AI model.

- Building when:
  - Building internally would provide a better understanding of the AI capabilities (including the inputs and code used)
  - Necessary inputs to build internally, like data and open-source code, are available
  - Building would provide or leverage a competitive advantage
  - Off-the-shelf AI capabilities may not fit the need
- Buying when:
  - Outside vendors could move faster (timing)
  - The AI capability sought is generic or widely available
- Cost estimating may include compute costs for data as a consideration or software-as-a-service model
- Having available, suitable, clean data as a key input in an AI model, where the type of data may define the need for the technology
- Having specific procedures for AI and performance metrics
- Considering resources available in systems for integration, like heat, space, and power, and ensuring buyers can use and understand a capability with these resources
- Having a technology roadmap for AI depends on end-user needs



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**Appendix III: Key Factors Selected Companies  
Reported Considering When Acquiring and  
Managing Artificial Intelligence**

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**Tailor Contracting Approach:** when contracting with vendors for AI capabilities, take steps to protect access to data and systems, such as using specific contract language to ensure access if the vendor goes out of business, and careful consideration of intellectual property concerns.

- 
- Avoiding vendor lock-in by holding regular competitions/having alternative vendors, and limiting the use of proprietary software
  - Handling intellectual property for AI on a case-by-case basis when buying AI, but building AI in-house can avoid intellectual property and enterprise agreement challenges
  - Buying AI should take into account data rights
  - Including contract language such as specific language to ensure access to proprietary data if company goes bankrupt, and using alternative contract structures to facilitate rapid AI procurement
  - Involving cross-functional teams, including, for example, subject matter experts, data scientists, legal representatives, contracting officials, and others in the buying process
  - Prioritizing system security and regulatory compliance in the procurement process
- 

**Test and Evaluate Proposed Solutions:** have a high tolerance for failure, try a technology before committing to ensure functionality and minimize unnecessary losses, and conduct oversight and monitoring to ensure consistent and ethical AI model performance.

- 
- Having a high tolerance for failure and (when failure is unavoidable) the ability to demonstrate failure quickly in order to move forward with alternatives
  - Trying before buying to ensure functionality and prevent unnecessary losses; starting with proofs of concept
  - Performing risk assessment to identify limitations in building or buying a new product
  - Prioritizing explainability of the model as important to the model's function
  - Understanding the system and including ethics and responsible AI
- 

**Plan Future Efforts:** forecast future AI capabilities that may be of value, including by building IT systems to maximize interoperability of capabilities over time.

- 
- Budgeting for AI is not different from other types of capabilities
  - Building IT systems and platforms to maximize interoperability, and considering future use cases, integration into systems, and adaptability
  - Offering AI-specific training for users, leaders, and talent managers
  - Having a culture supportive of AI, including a clear understanding by leadership of purpose and use of AI and enterprise-wide readiness through acceptance and corresponding infrastructure
- 

Source: GAO analysis of private sector information. | GAO-23-105850

## Appendix IV: Comments from the Department of Defense



ACQUISITION

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE  
3600 DEFENSE PENTAGON  
WASHINGTON, DC 20301-3600

Mr. Jon Ludwigson  
Director, Contracting and National Security Acquisitions  
U.S. Government Accountability Office  
441 G Street, NW  
Washington DC 20548

Dear Mr. Ludwigson:

This is the Department of Defense (DoD) response to the GAO Draft Report GAO-23-105850, "ARTIFICIAL INTELLIGENCE: DOD Needs Department-Wide Guidance to Inform Acquisitions," dated March 25, 2023 (GAO Code 105850).

The Department has no official written comments for inclusion in the report.

Sincerely,

SMITHCARROLLA Digitally signed by  
MY.SUNSHINE.123 SMITHCARROLL.AMY.SUNSHIN  
9564441 E:1239564441  
Date: 2023.05.30 09:45:01 -0400

Dr. A. Sunshine Smith-Carroll  
Director, Surface Warfare, Platforms and  
Weapons Portfolio Management

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## Agency Comment Letter

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### Text of Appendix IV: Comments from the Department of Defense

Mr. Jon Ludwigson  
Director, Contracting and National Security Acquisitions  
U.S. Government Accountability Office  
441 G Street, NW  
Washington DC 20548

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Sincerely,

Dr. A. Sunshine Smith-Carroll  
Director, Surface Warfare, Platforms and Weapons Portfolio Management

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## Appendix V: GAO Contact and Staff Acknowledgments

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### GAO Contact

Jon Ludwigson, (202) 512-4841 or ludwigsonj@gao.gov

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### Staff Acknowledgments

In addition to the contact named above, Raj Chitikila (Assistant Director), Erin Carr and Megan Stewart (Analysts-in-Charge), Lori Fields, Laura Greifner, Amanda Parker, and Carrie Rogers were principal contributors. In addition, the following people made contributions to this report: Victoria Adofoli, Jennifer Andreone, John Bornmann, Penney Harwell Caramia, Farahnaaz Khakoo-Mausel, Joshua Leiling, Sean Manzano, Miranda Riemer, Andrew Stavisky, Pamela Snedden, Jessica Steele, Anne Louise Taylor, Alyssa Weir, and Candice Wright.

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## Related GAO Products

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*Artificial Intelligence: Status of Developing and Acquiring Capabilities for Weapon Systems.* [GAO-22-104765](#). Washington, D.C.: February 17, 2022.

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