AI Readiness in a US Air Force Squadron

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Prioritizing artificial intelligence readiness in the US Air Force is vital. To confront this challenge, squadron commanders must spark (1) data-centric innovation and (2) artificial intelligence ideation at the warfighter level. Fusing Department of Defense policy with current management theory on digital transformation and strategy, this article explores crafting a data strategy, managing data infrastructure, cultivating technical talent, and redesigning organizational processes, all in support of fostering innovative culture at the squadron level. This unique action plan allows leaders to catalyze data-centric innovation into the artificial intelligence ideation process, posturing squadrons and parallel organizations in other services for digital warfare.

The proliferation of artificial intelligence (AI) technologies is leading to a rapid boost in productivity akin to a new industrial revolution.[1] Historically, as industries are transformed, jobs are replaced or added, and supply chains are rearranged, three main challenges emerge: domestic political stress, changing means of production, and potential technological singularity.[2] These stresses threaten the global world order by injecting inequality and insecurity into the international system.[3] As the proliferation of AI threatens to disrupt global stability, the United States has a key role to play in assuaging rising tensions. Google's generative AI chatbot Bard states,

> Nations should prioritize AI development because it has the potential to revolutionize many aspects of our lives, including the economy, healthcare, education, and national security. AI can be used to automate tasks, improve efficiency, and make better decisions. It can also be used to create new products and services, and to improve existing ones.[4]

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1. Nicholas D. Wright, "Artificial Intelligence's Three Bundles of Challenges for the Global Order," in *Artificial Intelligence, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives*, ed. Nicholas D. Wright (Maxwell AFB, AL: Air University Press, 2019), 17, https://www.airuniversity.af.edu/.
2. Wright.
3. Wright, 17.
4. Bard, response to "Why should nations prioritize AI development?," March 30, 2023, Google Bard, https://bard.google.com/.

America's peer and near-peer competitors are vying for AI research, development, and integration with respect to national security. For example, President Xi Jinping has stated the importance of "intelligentization" for China's national security objectives.[5] The People's Liberation Army has transcribed this goal into four possible AI use cases, including unmanned weapons, information processing, decision-making, and cognitive warfare. [6] Russia has also expressed a willingness to organize its defense sector for AI militarization, as evidenced by efforts from its Advanced Research Foundation (akin to the Defense Advanced Research Projects Agency).[7] The Ministry of Defence has even begun developing a defense innovation "technopolis" on the coast of the Black Sea, where it hopes to host an AI lab. [8]

Readying the US Air Force

In the US Air Force, AI readiness is crucial for tomorrow's digital war. Notably, the 2019 *United States Air Force Artificial Intelligence Annex* challenges all Airmen to understand and employ AI as a lever to increase productivity across the force.[9] In fact, a former chief of staff of the Air Force (CSAF) and former secretary of the Air Force emphasized the potential for this technology to fundamentally change the future, noting "everyone is responsible to purposefully consider and attempt to include AI in everything we do" and "[e]xploration, prototyping, and collaboration are not only encouraged, but critical to our future."[10] The annex provides a call to action, which perfectly encapsulates CSAF General Charles Q. Brown Jr.'s priority to accelerate change.[11] In sum, the Air Force's prioritization of AI as a critical technology indicates its fundamental relevance to increasing productivity across the defense industry.

To enable the Air Force's warfighters, guidance from senior leadership is essential for the establishment of a data backbone. But the Department of Defense has struggled to have lower-level units adopt enterprise-wide databases for mission-critical data that would enable higher-level model predictions. One reason is that the Defense Department does not yet have standardized automation or structured data analytics.[12] Until the

5. Koichiro Takagi, "Xi Jinping's Vision for Artificial Intelligence in the PLA," *Diplomat*, November 16, 2022, https://thediplomat.com/.

6. Takagi.

7. Samuel Bendett, "The Rise of Russia's Hi-Tech Military," American Foreign Policy Council (AFPC), June 26, 2019, https://www.afpc.org/.

8. Bendett.

9. David Goldfein and Matthew Donovan, *2019: The United States Air Force Artificial Intelligence Annex to the Department of Defense Intelligence Strategy* (Washington, DC: Department of the Air Force, 2019), https://www.af.mil/.

10. Goldfein and Donovan, 6.

11. Charles Q. Brown Jr., *Accelerate Change or Lose* (Washington, DC: Chief of Staff of the Air Force, August 2020), https://www.af.mil/.

12. Nick Harrison and Deborah O'Neill, "If Your Company Isn't Good at Analytics, It's Not Ready for AI," *Harvard Business Review*, June 7, 2017, https://hbr.org/.

data conditions for artificial intelligence/machine learning (AI/ML) are widespread, digital transformation should take the form of narrow use cases at grassroots levels.[13]

In the Air Force, the squadron is the appropriately tiered organization to pioneer this grassroots data-centric innovation. As former CSAF General David Goldfein stated,

> Our service culture and traditions manifest themselves in the squadron because our Airmen most readily identify with this core fighting unit. Squadrons are the engines of innovation and esprit de corps. Squadrons possess the greatest potential for operational agility.[14]

This examination and the recommendations focus on the squadron as the primary unit of analysis; recommendations are therefore aimed at squadron commanders. Applied to other US service echelons, these recommendations are appropriate for Army and Marine Corps battalions and Navy and Marine Corps squadrons. Squadron commanders must cultivate AI readiness by encouraging data-centric innovation and AI ideation at the warfighter level.

Background

While the recommendations apply military-wide, certain definitions and challenges unique to the Air Force context underpin this analysis.

Definitions

Artificial intelligence "refers to the ability of machines to perform tasks that normally require human intelligence."[15] This definition is employed widely and often without deep thought about critical considerations such as data, data pipelines, models, and human-centered design. Two broad distinctions in AI are of note: automation and prediction.[16] Automation is an expert system that accomplishes predictable tasks given a set of inputs. Automation is analogous to a standard Microsoft Excel spreadsheet which executes the same user-defined mathematical function given a set of inputs. Prediction forecasts an outcome based on data.

When considering the aspect of prediction, it is important to note the growth of machine learning. Instead of explicitly programming a mathematical function, ML enables the computer to write its own function to give a prediction; this prediction, in concert with a large corpus of data, is at the heart of modern machine-learning applications. This

13. John Anderson, Marc Losito, and Sean Batir, "The Commander's AI Smartcard: Artificial Intelligence Is Commanders' Business," Small Wars Journal, February 8, 2021, https://smallwarsjournal.com/.

14. David Goldfein, *CSAF Focus Area: The Beating Heart of the Air Force… Squadrons!* (Washington, DC: CSAF, August 2016), 1, https://www.af.mil/.

15. Goldfein and Donovan, *Artificial Intelligence Annex*, 3.

16. Greg Allen, *Understanding AI Technology* (Washington, DC: Joint Artificial Intelligence Center, 2020), https://www.ai.mil/.

prediction is analogous to the line of best fit in algebra, extrapolated to an unknown data point. Forms of ML include supervised learning, unsupervised learning, and reinforcement learning.[17]

Unique Challenges

Organizations generally encounter friction associated with digital transformation. Some specific challenges prevalent in the Air Force include information withholding, over-standardization, technical debt, and acquisition limitations.

Withholding information. Comprehensive data-centric transformation is contingent upon the entire defense workforce shifting its cultural disposition from "information withholding" to "information sharing."[18] Classification barriers, airframe-specific proprietary information, differing IT systems, and competition among units are all potential sources of friction in comprehensive data-centric transformation across the Air Force enterprise. Leaders should be mindful of these potential organizational barriers that may stifle information sharing and cross-organizational collaboration.

Over-standardization. In an operational military unit, practices are often standardized to enforce predictability and mitigate risk. Yet too much standardization can stifle out-of-the-box thinking, limiting the development of new techniques. In one study of a university flight school, researchers found that excessive standardization could result in a culture that stagnated innovation.[19] This, in turn, might limit students' exposure to technological advancements in aviation. Conversely, too little standardization might coincide with too much unfocused innovation, resulting in degraded discipline and professionalism. Air Force leaders must carefully weigh standardization and innovation when seeking to empower experimentation at the warfighter level.

Technical debt. Technical debt in an organization's IT infrastructure may slow adaptability. Technical debt, resulting from an agglomeration of inefficient software shortcuts to systems over time, can degrade comprehensive IT infrastructure.[20] While accumulating this debt might be an acceptable trade-off when pursuing rapid software development, stacking debt might also cripple systems with inefficiency, resulting in tangible costs.

In one example from civil aviation, Southwest Airlines' "antiquated" technology, complicated with manual processing and "spotty" technical improvements, resulted in an

17. Allen, 4.

18. Department of Defense (DoD), *DoD Data Strategy* (Washington, DC: DoD, September 30, 2020), 4, https://media.defense.gov/.

19. Michael Wetmore, Chien-tsung Lu, and Philip Bos, "Modeling the Balance between Standardization and Innovation in a Flight School," *Journal of Aviation/Aerospace Education and Research* 17, no. 3 (2008), https://doi.org/.

20. Philippe Kruchten, Robert Nord, and Ipek Ozkaya, *Managing Technical Debt: Reducing Friction in Software Development*, 1st ed. (Boston, MA: Addison-Wesley Professional, 2019).

operational IT meltdown in December 2022.[21] In this case, the interwoven yet outdated infrastructure caused cascading problems that disrupted operations. The Air Force also maintains archaic IT infrastructure that may pose problems when leaders seek to streamline digital transformation efforts. As an example, a former director of operations at the Department of the Air Force-Massachusetts Institute of Technology (MIT) Artificial Intelligence Accelerator expressed such frustration about his experience with computer lag that he penned a "fix our computers" call to action, prompting a joint response by several DoD chief information officers.[22]

Acquisition Limitations. The hype around AI will naturally inspire defense contractor solutions to data-centric challenges. Yet relying solely on contractor technical talent is imprudent, as the acquisition timelines are unacceptably uncompetitive in relation to those of near-peer competitors such as China.[23] Intellectual property law also prevents the transformation of a narrow-use case product into an enterprise-wide, scaled product. Consequently, contractor solutions can be narrow, stale, and expensive. Furthermore, warfighters, not contractors, are typically the end users of tools that weaponize data. Air Force leaders must weigh the inefficiency in contracting solutions and consequently inspire organic talent within their organizations. In other words, uniformed warfighters typically assume a significant role in readying the force for artificial intelligence.

Data-Centric Innovation

Artificial intelligence technologies are capable of increasing productivity and effectiveness at the operational Air Force level across a range of use cases from COVID-19 resource allocation to general staffing assignments to drone imagery analysis.[24] Yet the key to AI integration is data; data, a strategic asset, readies the digital landscape for artificial intelligence and machine learning. [25] From enhanced intelligence to all-domain targeting to integrated command and control, operationalized data will undoubtedly underpin future warfare.

For operational data across the Air Force, squadron commanders must engender data-centric innovation at the unit level. Inspiring innovation will lead to Airmen entrepreneurially finding opportunities to streamline data practices and architecture. After all, it is the frontline warfighter who often first realizes the effects of inefficient data use. With a data-centric mindset, warfighters may subsequently integrate AI technology. To inspire

21. Gregory Wallace, "Insiders at Southwest Reveal How the Airline's Service Imploded," CNN, December 30, 2022, https://www.cnn.com/.

22. Lee Ferran, "Military CIOs Say They Take 'Fix Our Computers' Rant 'to Heart,'" Breaking Defense, February 4, 2022, https://breakingdefense.com/.

23. Eric Lofgren, "China's Weapons Acquisition Cycle 5–6X Faster than the United States—'We Are Going to Lose' If We Don't Change," *Acquisition Talk* [blog], July 2, 2022, https://acquisitiontalk.com/.

24. Brandi Vincent, "Air and Space Forces Lean into Data-Informed Decision-Making," DefenseScoop, March 22, 2023, https://defensescoop.com/.

25. DoD, *Data Strategy*, 1–3; and Allen, *Understanding AI Technology*, 3.

data-centric innovation, a commander should craft a data strategy, adopt infrastructure, cultivate talent, redesign the organization, and shape innovative culture.[26]

Crafting a Data Strategy

The *DoD Data Strategy* provides a template for transforming the Department into a data- centric organization.[27] This overarching strategy articulates key priorities, including its eight guiding principles, four essential capabilities, and seven goals and associated enabling objectives.[28] Commanders can weave this guidance together with their organi-zation's headline mission statement to craft a data strategy. A nuanced data strategy is necessary for data- centric mission success because it outlines clear pathways for frontline service members to understand how to think about the role of data in everyday operations.

By crafting a data strategy, a commander establishes a beacon around which the squadron can mobilize. A comprehensive strategy has certain critical components: a measurable objective, defined scope, and articulated advantage.[29] It is a reflection of the value proposition and brand positioning of that organization. For example, IKEA's value proposition sets itself apart from other furniture stores in that it articulates to customers what to expect and what not to expect: IKEA is a discount furniture store with a modern look and an exciting maze of showrooms. Customers can expect that IKEA furniture will not be assembled or delivered.[30] The retailer's mission statement commits "to offer a wide range of well-designed, functional home furnishing products at prices so low that as many people as possible will be able to afford them."[31]

An effective strategy should consider resources for and limitations of operationalizing data in tandem with the squadron's primary mission. Importantly, most squadrons will find resources—such as funding, technical talent, and data infrastructure—are scarce.[32] Moreover, operational bandwidth might also be limited, especially in a busy squadron. Yet a commander can carefully engender innovation by holding the unit accountable for

26. Charles A. O'Reilly and Michael L. Tushman, *Winning through Innovation: A Practical Guide to Leading Organizational Change and Renewal*, rev. ed. (Boston, MA: Harvard Business School Press, 2002).

27. DoD, *Data Strategy*.

28. DoD, 3–9.

29. David J. Collis and Michael G. Rukstad, "Can You Say What Your Strategy Is?," *Harvard Business Review*, April 2008, 4, https://hbr.org/.

30. Alessandro Di Fiori, "The Art of Crafting a 15-Word Strategy Statement," *Harvard Business Review*, February 12, 2014, https://hbr.org/.

31. "The IKEA Vision and Values," IKEA (website), accessed July 10, 2023, https://www.ikea.com/.

32. John A. Ausink et al., *Improving the Effectiveness of Air Force Squadron Commanders: Assessing Squadron Commander Responsibilities, Preparation, and Resources* (Santa Monica, CA: RAND Corporation, 2018), 34, https://doi.org/.

marginally more than it can control with given resources.[33] In this gap lies the incentive for entrepreneurialism.

A data strategy should revolve around the inevitable integration of data and predictive technology like AI. Through this lens, it could be useful to consider a fundamental machine learning formula: data + algorithm + training compute = prediction.[34] Fine-tuned prediction, in turn, might hone process efficiency and effectiveness. This strategy should integrate these concepts into the unit's competitive positioning. In crafting the strategy, a commander must also consider where data currently exists in the organization as well as methods of automating data collection and curation. Lastly, a cohesive data strategy should tie these curation efforts to higher headquarters' strategy, efforts, and guidance so that the organization is well poised to meet the squadron and senior leadership priorities.

The idea of a data strategy is fairly novel; however, a few case studies illustrate how leadership might think about the implications of data strategy. In 2018 and 2019, Procter & Gamble crafted a data strategy as a part of its data-centric digital transformation.[35] Initially, the data strategy articulated baseline policies upon which smaller units could tailor their frontline execution. Yet the company faced some unique tensions regarding data governance—namely, the leadership team debated how restrictive these policies should be. If the policies were overly restrictive, leadership could retain standardized control over execution; if the guidelines were looser, frontline employees could tailor policies directly with execution priorities. Inevitably, where leaders fall along this continuum sends a signal to the organization and should be aligned with how much agency leadership wishes to cede to operators.

In the Air Force context, such policies regarding control are, effectively, mission command. The consideration regarding operator agency is a decision about balancing centralized command, distributed control, and decentralized execution.[36]

Like Procter & Gamble, the Air Force Installation and Mission Support Center (AFIMSC) also operationalized data strategy. The 2021 AFIMSC strategy supports "DoD and Air Force data efforts, establishes AFIMSC data governance structure, advocates for AFIMSC data sharing, supports data-aware organizations, and provides Airmen tactical advantage through data."[37] This strategy underpinned the organization's success in being one of the first to use the VAULT (visible, accessible, understandable, linked, and trusted) data platform, a unique data visualization tool. Through this tool, AFIMSC

33. Robert Simons, "Designing High-Performance Jobs," *Harvard Business Review*, July–August 2005, https://hbr.org/.

34. Neil D. Lawrence, "Data Readiness Levels," arXiv, May 5, 2017, 1, https://arxiv.org/.

35. Srikant M. Datar, Sarah Mehta, and Paul Hamilton, "Applying Data Science and Analytics at P&G," Harvard Business School Case 121-006, July 7, 2020, 4–5.

36. Headquarters, US Air Force, *The Air Force*, Air Force Doctrine Publication 1 (Maxwell AFB, AL: Curtis E. LeMay Center for Doctrine Development and Education, March 1, 2021), https://www.doctrine.af.mil/.

37. Malcolm McClendon, "AFIMSC Accelerates Change across the Enterprise with Big Data," Air Force Installation & Mission Support Center, July 17, 2021, https://www.afimsc.af.mil/.

harnesses data and shares it with commanders to provide greater perspective on installation health, effectively eradicating months of work.

Adopting Infrastructure

Curated, organized, and labeled data, as well as flowing data pipelines, are infrastructure upon which technical talent will inevitably innovate. An action team consisting of the commander, director or assistant director of operations, security officer, tactics officer, and intelligence specialist would be well poised to identify and assess the squadron's data infrastructure. This team can outline the initial sources of data, identify respective data readiness levels, and maintain data pipelines.[38] As a starting point, one possible source of data might be the key performance metrics that a commander requests of their staff for weekly, monthly, or quarterly reports. These metrics and their derived data sources are likely what can be collected for automated reports. Later, these same databases could be used for predictive analytics.

The team should identify actionable first steps toward bolstering and sharing data pipelines with all relevant Airmen and organizations. For additional guidance, the Department of the Air Force chief data and AI officer has outlined various data platforms which can be adopted with the proper security controls in mind. Finally, there might be other units, combatant commands, major commands, or higher headquarters that use these same processes and data foundations. Squadron data are important elements of higher headquarters' decisions; consequently, commanders should ensure the proper flow of data up the chain of command. Finally, the responsibilities of this action team and management of squadron data infrastructure may eventually shift to the chief technology officer (CTO, described below).

As an example of how strategy informs data infrastructure, Procter & Gamble debated data management extensively.[39] For information that could be widely used by the entire organization, the leadership team saw a clear use for centralizing it in a consolidated data repository—a data lake.[40] Effectively, this allowed multiple divisions to draw upon the same information for analysis and operations. Yet the organization also created smaller data hubs that pooled centralized data and added regional flavor. [41] The key tension with this model was the question of how much standardization to apply to the smaller data hubs. In the Air Force context, this sort of a centralized/decentralized hybrid model might best maximize data-sharing and unit-level security implications.

In the Air Force, there are two tools that might help squadron data teams streamline data efforts. The VAULT Platform gives teams the ability to upload, manage, and share

38. Lawrence, "Data Readiness Levels."
39. Datar, Mehta, and Hamilton, "Data Science," 4–5.
40. Google Cloud, "What Is a Data Lake?," Google Cloud, accessed July 10, 2023, https://cloud.google.com/.
41. Datar, Mehta, and Hamilton, "Data Science," 5–6.

data.[42] From this platform, data teams can build machine learning algorithms and display data in an unprecedented way, enhancing productivity across the enterprise. Additionally, the Air Force Research Lab's redForce AI is a DevOps platform that supports AI project development, including in the data preparation phase.[43]

Cultivating Talent

Managing technical talent is perhaps the greatest challenge that any data-centric organization faces. For context, corporate technology companies as well as world-class defense innovation units, like Kessel Run, struggle with this.[44] One Air Force unit experimented with unique organizational changes to cultivate and augment its technical workforce: the Department of the Air Force MIT Artificial Intelligence Accelerator.[45]

Tasked to solve some of the most technical problems in the Air Force, this small unit needed the best talent available. First, it leveraged its partnership with the university to network with civilian researchers, professors, and experts. Additionally, it established temporary fellowships to locate, upskill, and employ Air Force talent from other organizations. The unit also created open-access challenges with scrubbed, public datasets in the hopes of piquing the interest of civilian software engineers. The Accelerator case highlights some innovative ways in which a military unit can cultivate talent through unique organizational design principles.

Additionally, one valuable Air Force resource is often overlooked. Digital University, a joint venture of the US Air Force and US Space Force, is a free education platform for Airmen and Guardians, and courses span a wide variety of technical material.[46] By promoting Digital University, commanders can motivate curious Airmen to build data literacy through focused coursework. The squadron commander might encourage flight leadership to authorize each Airman several work hours per week for education. Such incentives can be institutionalized; for example, learning-path completion might be included in officer and enlisted performance reports.

Finally, executive courses on AI and ML could offer squadron and flight leadership an opportunity to learn how data tools can increase workplace productivity. In this way, leaders can identify and guide use cases in a more informed way.

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42. Secretary of the Air Force Public Affairs, "Chief Data Office Announces Capabilities for the Vault Data Platform," US Air Force (website), October 11, 2019, https://www.af.mil/.

43. "Modernized Acquisition of AI Capabilities from Need to Operations in Months," redForce, Air Force Research Laboratory, accessed March 31, 2023, https://redforceai.us/.

44. Anthony Goldbloom and Craig Wiley, "Hiring Exceptional ML Talent: Top Qualities We Look for at Google," *Forbes*, March 15, 2021, https://www.forbes.com/; and Damany Coleman, "Kessel Run Hosts Software Working Group," KesselRun, August 4, 2022, https://kesselrun.af.mil/.

45. See Maria P. Roche and Alexander Farrow, "Accelerating AI Adoption in the US Air Force," Harvard Business School Case 723-429, March 2023.

46. "Empowering Tomorrow's Warfighter," Digital University (website), accessed March 31, 2023, https://digitalu.af.mil/.

Redesigning the Organization

Positioning technical talent within the organization is critical. The initial inclination might be to place talent in the tactics shop. Relatedly, a commander might create a separate data shop that works closely with IT or security. The advantages of these approaches are that homogenous teams might enhance group learning and ideating, potentially resulting in ideas originating in one central office.[47] Yet concentrating talent elicits groupthink, subgroup factions, and consequently, poor information-sharing across the organization.

In fact, this was the exact issue that the Procter & Gamble leadership team contemplated as they sought to prioritize data-centric analytics in 2018 and 2019.[48] At first, leadership embedded the data scientists within operational teams. Yet they quickly realized that managers viewed data scientists as outsiders to the frontline team; consequently, managers sometimes dismissed their key ideas. By failing to understand the full scope of the data scientists' skills, managers often did not employ them effectively to the mission.

To preempt data scientists' frustration and decreased morale, company leadership established a centralized technical talent staffing model, fostering community and standardized collaboration. Of course, pooling talent outside of the business units risked losing some adaptability at the operational level. Effectively, designing technical talent placements is a balance and carries tradeoffs.

In the Air Force context, one approach is to designate—as an additional duty—a data architect in each flight or shop. First, this promotes greater information diversity in the flights, which translates to more holistic problem-solving.[49] Second, embedded data architects can source opportunities to implement data-driven innovation in a more decentralized, organic manner. Use cases will address a vast variety of problems across the organization.

Furthermore, all data architects should report to a chief technology officer who is integrated directly with squadron leadership. An appropriate placement for this officer is at the assistant director of operations level, where they can work closely with injecting technical perspective into operational discussions. Formalizing this role legitimizes its integral importance at the leadership level. The CTO should also assume responsibility for continuously managing the overall data flows across the squadron's lines of effort, aiming to assess and upgrade data readiness levels wherever possible.

Lastly, the squadron must track technical talent as a component of career development. This element is important because it allows leadership to intentionally assign an experienced data architect to a squadron shop or other unit that will best capitalize on their

47. Cristina Gibson and Freek Vermeulen, "A Healthy Divide: Subgroups as a Stimulus for Team Learning Behavior," *Administrative Science Quarterly* 48, no. 2 (2003), https://doi.org/.

48. Datar, Mehta, and Hamilton, "Data Science," 6–7.

49. Karen A. Jehn, Gregory B. Northcraft, and Margaret A. Neale, "Why Differences Make a Difference: A Field Study of Diversity, Conflict, and Performance in Workgroups," *Administrative Science Quarterly* 44, no. 4 (1999), https://doi.org/.

unique education and experience. In a flying squadron, flight qualifications differentiate experience levels—that is, experienced pilot, instructor, and evaluator. A commander can institutionalize a similar tracking mechanism for technical talent with special experience identifiers (SEIs). The training shop can institutionalize standards for awarding an SEI, propose the new SEI to the Air Force enlisted/officer classification directory, and ensure each data architect's official records reflect this upgrade.

Shaping Culture

Building a culture of sustained innovation can be difficult because innovation is experimentation, which does not always translate to measurable key performance indicators or in annual reports. Yet, to press the boundaries of innovation, an organization must empower employees to experiment, even if only one of multiple theoretical projects proves successful. In other words, the organization must allow for experimentation risk.

Moog, an engineering company with a history of defense contracts, maintains a culture of supportive experimentation.[50] Through a flat hierarchy and culture of collaborative togetherness, the company fosters empowerment. In one instance, when a client demanded that an employee be fired for a mistake, the chief executive officer quickly dismissed this demand and defended the employee.[51] It was common for the chief executive officer to directly call a junior employee and source their opinion.[52] Additionally, internal awards like the HR Hero Award gave peers a chance to nominate and highlight exceptional performance.[53] Effectively, these practices lessen the risk of experimentation failure, empower employees to take risks, and affirm the organization's commitment to innovation.

In the Air Force, rigid hierarchy, annual budgets, and performance reports work against an experimental culture. Yet a squadron commander can encourage innovative practices at the operational level. Squadron and flight commanders should cultivate an environment in which Airmen feel empowered to innovate because leadership assumes innovators operate with productive, responsible intent. For example, this might manifest in a scenario in which a senior MQ-9 pilot accepts more mission risk when a junior aircrew member experiments with a new process for piping mission data. In this case, yielding some procedural rigidity to promising experimentation conveys a message of leadership flexibility.

In addition, by publicly rewarding data-centric innovations, squadron and flight leadership will highlight talent, signal support, and incentivize subsequent experimentation. One costless mechanism for doing this might be to establish new squadron monthly and quarterly awards, such as a top innovator or top data disrupter.

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50. Brian J. Hall et al., "Innovation at Moog Inc.," Harvard Business School Case 922-040, March 2022 (revised January 2023).
51. Hall et al., 4.
52. Hall et al., 5.
53. Hall et al., 4–6.

AI Ideation

After the squadron's data-centric innovation ecosystem is primed, AI needs to be integrated to increase productivity. In this phase, leadership can task supervisors throughout the unit to embark upon an AI ideation process. The goal of this process is to discover ways to improve processes through an AI lens, as well as methods for how to acquire data-driven solutions. The following framework serves as guidance for how to craft an action plan for the AI ideation process.[54]

Phase 1: Diagnosis

The first step of a thorough ideation action plan is a comprehensive diagnosis of the problem. This diagnosis begins by broadly outlining a problem that might be remedied by the application of AI. Next, analyzing the problem involves identifying foundational causes. One technique for uncovering root causes of technical problems, called the 5 Whys, is employed by the Toyota Production System; the technique essentially involves asking why five times, which typically results in the diagnoses of the causes.[55]

Each root cause has several key considerations, including organizational context, stakeholder concerns, leadership guidance, and legal constraints. Identifying the considerations for each root cause may help illuminate some common roadblocks across different problem areas. Conducting research into potential public and commercial solutions will help leaders understand how to address any root causes. Gathering this perspective will help determine when to innovate, when to acquire, and when to employ a combination of both.

During ideation, limited resources should not constrain action planning. Instead, leadership could adopt the following forward-leaning definition of entrepreneurial management: "the pursuit of opportunity without regard to resources currently controlled."[56] Also, a good diagnosis identifies competitive advantages. Perhaps the squadron has an information advantage because it is the inevitable end-user of the solution.[57] Maybe certain squadron leaders retain expertise, network, and authority that might help pool key resources together. This step will help identify why the squadron is best positioned to undertake this project.

Weaknesses also need to be identified. What perspective, skills, talent, or assets are missing that will be critical to the success of the project? Importantly, AI fixes cannot be ascribed to all workplace problems. For example, a developer might identify a way to use a ML model to sort an email inbox by priority. If this user's primary goal is to lessen the

54. Tsedal Neeley, "Six Simple Steps to Action Planning," Harvard Business School Background Note 421-033 (August 2020).

55. Eric Ries, "The Five Whys for Start-Ups," *Harvard Business Review*, April 30, 2010, https://hbr.org/.

56. Tom Eisenmann, "Entrepreneurship: A Working Definition," *Harvard Business Review*, January 10, 2013, https://hbr.org/.

57. Scott Shane, "Prior Knowledge and the Discovery of Entrepreneurial Opportunities," *Organization Science* 11, no. 4 (July–August 2000), https://doi.org/.

volume of emails they are receiving, perhaps they might assess that they need to delegate more tasks to subordinates rather than rely on a potentially imperfect ML model.

Phase 2: Goals

The overall objective of a project needs to be defined. This process involves hypothesizing specifically which type of AI might help best achieve an objective: automation or machine-learning predictions. Some additional important considerations that will frame the scope of this goal might include command guidance, classification considerations, or legal constraints. The goal should be appropriately narrow.[58] It is not feasible, for example, to set the goal of fixing an enterprise-wide problem when the problem resides at the squadron level. Conversely, an overly narrow solution might already exist commercially.

Phase 3: Actionable Steps

Outlining actionable steps to operationalize an idea will help structure the workflow. Although there is room for creativity in how to craft each step, some important AI-specific considerations are as follows:

Data engineering will likely encompass most of the effort, as AI relies on sustainable, training-quality data. A machine-learning model will require consistent training, validation, and testing data throughout its lifecycle. Broadly, this involves evaluating the readiness of the available data to minimize the incidence of collection unreliability, mislabeling, missing values, privacy, and proprietary concerns.[59]

A reliable data pipeline should continuously feed new data to machine-learning engineers to ensure sustainability. This data pipeline should rest on automated and standardized data processes to minimize the cost and time of maintaining the flow.[60]

A plan to operationalize the squadron's assets to build an appropriate model might include considerations of inherent expertise and resources. The unit will benefit when a leader recruits, acquires, or develops the means to choose the best algorithm to train, test, and deploy the best model. The best model might not always be the most complicated one; a logistic regression may be able to achieve the objective better than a deep neural network. In other words, if the equation to predict a specific outcome is as simple as $y = mx + b$, it may not be necessary to develop more complicated models.

It is also important to identify an outlet in the organization that will enable the team to build the right model with the appropriate computing power for both training, testing, and validation as well as deployment.[61] There are resources that might help host and run an AI solution, including the Air Force Research Laboratory's redForce AI.[62]

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58. Anderson, Losito, and Batir, "Commander's AI Smartcard," para. 9.
59. Lawrence, "Data Readiness Levels."
60. Harrison and O'Neill, "Ready for AI."
61. Anderson, Losito, and Batir, "Commander's AI Smartcard," para. 13.
62. "Modernized Acquisition of AI."

Phase 4: Implementation

A timeline for the actionable items will provide a framework to guide implementation. Specifically, the timeline should include when and how long each step will take to accomplish. It is also important to determine if the steps will occur in a specific order or at the same time. Specific, measurable key performance indicators allow the success of each action to be evaluated as it relates to the original project goal. If the project does not sufficiently meet the project goal, the key performance indicators should be prescriptive enough to pave a pathway for future projects.

A human-centered approach is critical.[63] With emphasis on the user, leaders should engineer the lifecycle of the solution to collect, transfer, and curate data using the following questions: how will the model be trained and improved with feedback from users? How will the users interact with its predictions? How will these goals be incorporated into day-to-day operations and give value back to the team in time saved or increased mission effectiveness?

Phase 5: Limitations

Lastly, the project's limitations need to be assessed. One possible limitation might be funding the development of the solution. For example, the feasibility of leveraging a local engineer's time and resources for this project might be considered. This manpower might then be replaced by a free open-source product or a purchased proprietary tool. Another important limitation is cultural fit. The solution may need to be redesigned so that the organization can fluidly sustain and iterate on the work.

Conclusion

To bolster AI readiness in the US Air Force, commanders at the squadron level must inspire grassroots data-centric innovation and subsequently integrate artificial intelligence. A squadron commander can inspire innovation by first establishing a concrete data strategy. They can support this strategy by building better data infrastructure, cultivating talent across the organization, redesigning the squadron, and growing a culture of innovation. Data-centric transformation happens at the warfighter level, and the squadron commander is the essential change agent who will spark the flame of AI readiness.

A commander can build upon a data-centric unit by encouraging AI integration into organizational processes. To do this, they should follow a rigorous AI ideation process to spark innovation at the grassroots level. Specifically, this ideation process guides Airmen through five distinct phases: (1) diagnosis, (2) goals, (3) actionable steps, (4) implementation, and (5) limitations. By following this flow, squadrons can enable Airmen to translate the unit's data resources and infrastructure into tangible productivity gains. These productivity gains will strengthen and ready the Air Force for digital warfare. ✈

63. Lauren Landry, "What Is Human-Centered Design?," Harvard Business School Online, December 15, 2020, https://online.hbs.edu/.