

Data-Driven Leadership: Empowering Army Aviation for Mission Success

U.S. Army Aviators from the 3D Combat Aviation Brigade, 3D Infantry Division, fly a formation of helicopters in support of Marne Week events on Fort Stewart, Georgia. U.S. Army photo by SGT Savannah Roy.

By COL Ryan P. Sullivan

In today's rapidly evolving military landscape, the ability to effectively harness and leverage data is a game-changer for organizations that must do more with less.¹ Army Aviation is no exception. Operating across complex operational environments, units can significantly benefit from leveraging data in delivering combat aviation brigades that balance capacity and capability to deliver on aviation core competencies to see/sense – strike – move – extend the operational reach of divisions. Embracing the principles of data-driven leadership is crucial for staying competitive and responsive to changing battlefield realities, balancing now vs. the need to preserve combat power for decisive operations. Technological advancements like digital twins;² system-level embedded diagnostics (SLED) and smart tool for aviation maintenance picture (STAMP),³ along with analytic tools in fielding like Griffin Artificial Intelligence (AI); and the Aviation Maintainer Analytics Platform (A-MAP) mark significant progress within our formations, aspiring to create environments characterized by precision and performance akin to Formula 1 (F1) racing.

This article explores the crucial role of data in empowering leaders and emphasizes the significance of data-driven practices in aviation. It draws insights from the Army Data-Driven Leadership [DDL] Certificate Program hosted by Carnegie Mellon University, Heinz College of Information Systems–Public Policy–Management, prioritizes data literacy, and discusses challenges and opportunities present through value extraction models. While it's tempting to present definitive guidelines or a guaranteed roadmap for maximizing the benefits of data utilization within formations, the reality is that this transformation is challenging, and each unit is at a different stage of its journey. Our unit does not have all the answers and is just beginning its own journey. However, initiating discussions, encouraging leaders to ask questions, sharing lessons learned, and committing to fostering a data-driven culture are crucial first steps.

Prioritizing Data Literacy

Prioritizing data literacy is vital for Army Aviation leaders due to its potential to provide invaluable insights essential for

decision-making. Data-driven decision-making presents numerous opportunities, from identifying areas for improvement in aircraft maintenance and flight operations, to refining mission planning and execution. Furthermore, leveraging data fosters continuous improvement and encourages innovation. Notably, data collection and analysis meaningfully enhance safety within Army Aviation. By meticulously tracking and examining safety-related data, leaders can proactively identify patterns and trends, thereby preemptively addressing safety hazards and averting adverse outcomes. Prioritizing data collection in areas such as aircraft performance, maintenance records, flight operations, and safety incidents is essential for Army Aviation leaders. This emphasis enables leaders to understand the factors influencing overall performance and safety within their aviation units, empowering them to utilize business intelligence (BI)⁴ effectively.

The Army utilizes BI to facilitate informed decision-making and enhance operational efficiency by collecting,

¹ One such example is the Army Force Structure Transformation. Army leaders, who consulted with Congress, will move forward and bring down "authorized" troop levels to "approximately 470,000 Soldiers by FY2029" (U.S. Army Public Affairs, 2024).

² "A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making" (Armstrong, 2020).

³ "The STAMP dashboard changes to reflect the aircraft's current status so the maintainers can quickly see Warnings, Cautions, Advisories, Faults and Exceedances (WCAFEs) as they occur on an aircraft. It can also distinguish between an aircraft that has landed at home versus an aircraft that has been forced to perform a precautionary landing. From the Dashboard, the maintainer can easily delve deeper into the full SLED report to gain detailed information regarding the WCAFEs" (Herman & Ingraham, n.d.).

⁴ "Business Intelligence refers to technologies, applications and practices for the collection, integration, analysis, and presentation of business information" (Crech, 2020).

processing, analyzing, reporting, and strategically planning with data. Leaders must recognize that BI primarily relies on structured data and looks backward, providing historical insights. Leaders should exercise caution in adopting AI if their formation struggles with BI. For instance, the emergence of the natural language processing chatbot, ChatGPT, has made generative AI more accessible, presenting opportunities for exploration across various applications. The Army's Artificial Intelligence Integration Center (AI2C) developed and released CamoGPT specifically for military use.⁵ Utilizing CamoGPT to assist in writing this article, a query on the benefits of developing data-driven leaders highlighted several key areas:

1. Leveraging real-time intelligence and operations.
2. Anticipating challenges with predictive analytics.
3. Ensuring personnel readiness through data-driven human resources management.
4. Resource management in a data-driven environment.
5. Utilizing predictive analytics for maintenance operations.

This is not a bad list; however, it is probably incomplete and not something a data scholar would produce. Generative AI is a tool and not the final solution. Data-driven leadership represents a paradigm shift, empowering units to anticipate challenges and make informed decisions against an uncertain future. By understanding the power of data and its potential to revolutionize decision-making processes, leaders can drive their organizations toward better outcomes and greater success. Change will not and cannot come overnight, but there is risk in not improving data literacy, characterized by:

1. Ineffective decision-making.
2. Reduced efficiency and effectiveness.
3. Safety concerns.
4. Missed opportunities for innovation.

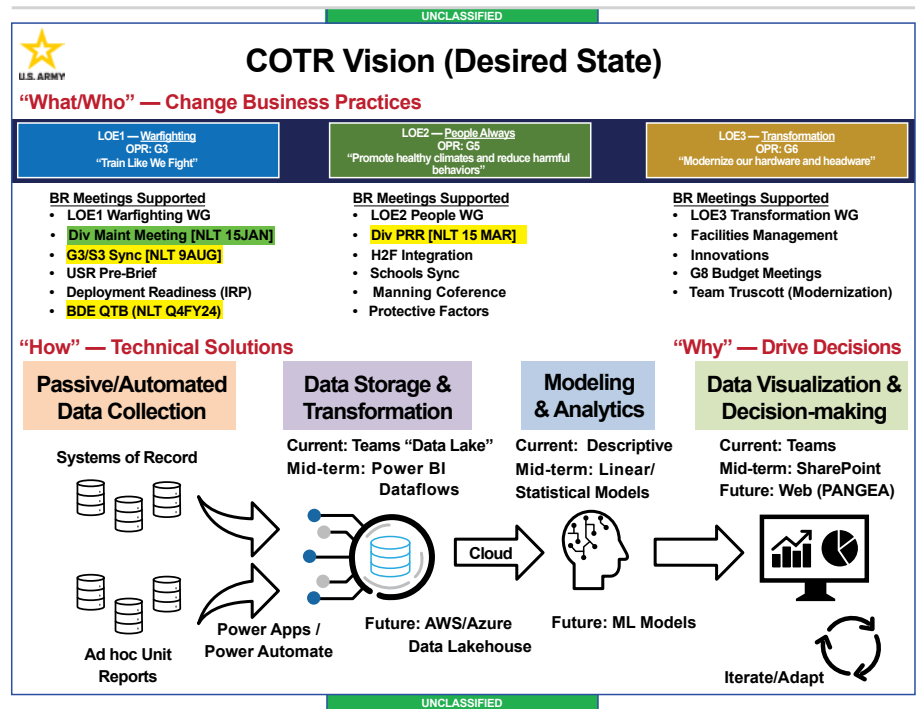


Figure 1. 3D Infantry Division's "COP (Common Operating Picture) of the Rock" (COTR) vision (desired state). Slide used with permission from 3ID, MAJ DaNeve and MAJ Quigley, March 2024.

5. Lack of accountability and transparency.
6. Inability to adapt to evolving threats and challenges.

While some of these risks may seem obvious or intuitive, the **lack of accountability and transparency** is particularly noteworthy. The Army increasingly relies on tools like Army Vantage, "the Army's data-driven operations and decision-making platform," (U.S. Army Program Executive Office Enterprise Information Systems, n.d.) and dashboard visualizations such as the 3D Infantry Division's COTR (Figure 1). Without sufficient data literacy, units may be unable to effectively utilize dashboards to accurately assess and communicate their performance, potentially eroding stakeholder accountability and trust. Therefore, Army Aviation leaders must prioritize learning and the importance of becoming data-driven leaders. I used ChatGPT to assist in defining the following essential key terms.

1. Analytics Continuum: Refers to the progression of data analysis from basic reporting and descriptive statistics to predictive and prescriptive analytics (Figure 2). LTC Thomas Dirienzo, Senior

Data Scientist at AI2C shared that, "the continuum is hard not only because of the complexity of the work, but because it relies on all of the others' steps along the continuum to be in place" (T. Dirienzo, personal communication, March 9, 2024).

- 2. Data Warehouse:** A centralized, relational database designed to optimize data querying and reporting across an organization, consolidating data from various sources into one consistent view.
- 3. Data Lake:** A large, distributed repository of raw or structured data that can be easily accessed, processed, and analyzed by various tools and services with minimal setup effort.
- 4. Data Lake House:** A modern approach to managing data architecture combining the best aspects of data lakes (scalability, flexibility) and data warehouses (structured, consistency).
- 5. Data Mesh:** A decentralized, domain-driven approach for managing and processing data across an organization where data ownership lies amongst the business teams.
- 6. Data Fabric:** An architecture that inte-

⁵The AI2C announced the early access release (alpha version) of CamoGPT on January 25, 2024. "CamoGPT is designed to be flexible and model agnostic, enabling it to adapt to a wide range of tasks and integrations. This versatility ensures that it remains an indispensable tool for your productivity needs ... CamoGPT comes with robust security features. It operates in a closed domain, ensuring your data, prompts, and responses remain secure within the Army's security boundaries ... CamoGPT is hosted on NIPR, SIPR, cloud, and, soon to be, edge environments" (LTC Eric Justin Schmitz, CamoGPT Teams post).

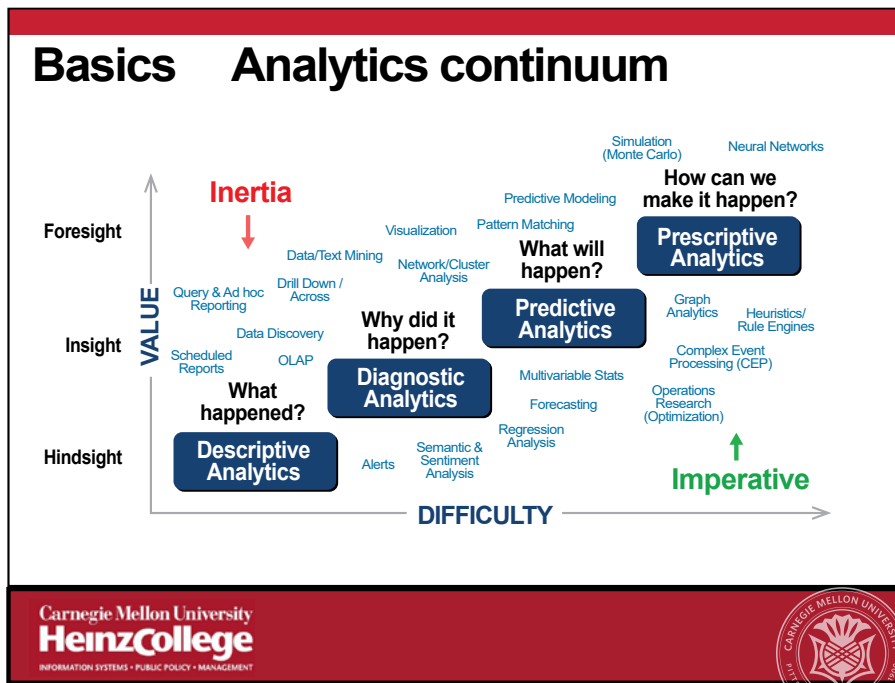


Figure 2. Analytics continuum. Figure provided by Carnegie Mellon University, Heinz College, hosts of the Army DDL certificate program, 2023.

grates various data management components such as data lakes, data warehouses, and other systems into a unified, single pane-of-glass interface for efficient data-driven decision-making (OpenAI, 2024).

Expanding on the definitions, data mesh is an organizational framework rather than a specific product, while data fabric refers to a centralized technical architecture (such as the next-generation data analysis company, Palantir, or Microsoft products). Using Army Vantage doesn't necessarily require coding skills. However, understanding how systems of record feed directly into software applications or into data lakes is essential for informed discussions from senior leaders, especially when discrepancies arise in data accuracy or timeliness for reporting periods. Leaders need to prioritize data literacy to avoid falling behind adjacent or higher commands and missing opportunities for continuous improvement, innovation, and enhanced safety within their units. These opportunities come with challenges, which I will explore in the next section.

Implementing data-driven leadership presents challenges, including managing data volume, velocity, variety, and value. Overcoming these challenges is crucial for maximizing the benefits of data utilization. Investing in modern

technologies like cloud computing, big data analytics, AI, and machine learning is essential for enabling data-driven decision-making. However, much of this occurs external to our commands. Understanding the transformations in our operating environments revolves around accepting that data are essential for militaries worldwide. By investing in modern technologies, military organizations can harness data's power to improve mission success, reduce costs, increase efficiency, and enhance situational awareness. LTC Dirienzo provides one such example, "Griffin [AI] is largely possible because the Army invested in a data lake that makes data visible and accessible" (T. Dirienzo, personal communication, March 9, 2024).

However, embracing data-driven leadership involves addressing several challenges highlighted by CamoGPT:

- 1. Data Accessibility:** Army Aviation leaders may face challenges accessing reliable and up-to-date data from multiple sources and platforms, essential for informed decision-making.
- 2. Data Integration:** Integrating data from various sources, including aircraft systems, maintenance records, mission reports, and external sources, can be

complex and time-consuming, making it difficult for leaders to obtain a comprehensive and accurate picture of the situation.

3. Data Analysis: Identifying valuable insights and patterns from large volumes of data can be challenging, especially if leaders need more analytical tools and skills to make sense of the information.

4. Data Security and Privacy: Protecting sensitive aviation-related data from unauthorized access, misuse, or cyber threats is a critical concern for leaders who must balance the need for transparency and collaboration with safeguarding classified information.

5. Training and Resources: Army Aviation leaders may face challenges in providing their personnel with the necessary training and resources to effectively collect, analyze, and interpret data, as well as in implementing the essential technology and infrastructure to support data-driven decision-making.

6. Cultural Resistance: Leaders may encounter resistance to incorporating data-driven decision-making within the organization's culture, as some personnel may be more accustomed to relying on experience, intuition, or traditional methods of decision-making.

7. Change Management: Incorporating data-driven decision-making into existing processes and workflows can be disruptive and require significant change management efforts to ensure that leaders and their teams embrace the new approach.

While the list appears comprehensive at first glance, the narrative needs additional context that individuals outside of aviation may not grasp. For instance, our current organizational structure lacks designated military occupational specialties for data scientists within our formations, and the capability to organically collect, store, extract, and load data is absent. Further complicating matters is the ownership and access to data stored in numerous black boxes, necessitating our reliance on Field Service Representatives (FSR) who "are embedded with the military to assist Soldier's [sic] with technical support, troubleshooting mission

commands, and network capabilities” (Colvin, 2019). These challenges make it difficult for Army Aviation leaders to prioritize and analyze data from various sources effectively, requiring them to develop strategies and capabilities to navigate these complexities effectively. The next section will delve into the evolving processes to extract value.

Extracting Value From Data

In today's fast-paced and ever-changing world, data have become an indispensable tool for decision-making and problem-solving, particularly in Army Aviation, where leaders constantly face complex decisions impacting mission success. In framing the problem and to extract value from data, there are three essential questions:

1. What decision is being improved?
2. Who is deciding?
3. What is the value of an improved decision?

These three questions are essential for anyone seeking to frame a problem to extract value from data. Tapping into the value of unstructured data within data lakes is necessary for our formations to move from hindsight to foresight along the analytics continuum. Most units perform above average in descriptive analytics in the form of daily status reports, command and staff slides, and other dashboard visualizations that tell us what happened. Data-enhanced units and leaders may understand how to leverage tools for diagnostic analytics, answering why it happened. However, only some units are data mature and understand how to leverage data and emerging technology to move toward predictive or prescriptive analytics. Those formations would experience a higher likelihood of knowing what will happen and, even more importantly, what leaders should do next.

Without solid data management fundamentals and commitment to BI from leaders to break through silos of excellence within our formations, we cannot expect generative AI or software platforms to solve every problem magically. While this section addresses challenges and risks, it also highlights opportunities. The operation of our airframes relies

heavily on data-driven algorithms that enhance flight, improve accuracy, and ensure safety beyond previous generations. Much of these data reside within the black boxes of our aircraft, accessible to original equipment manufacturers through an FSR. Although there may come a time when these data are more accessible to us, it's crucial to build the necessary understanding and organizational structure to extract value from the vast amounts of untapped data. While we may have access to only some of the data, there remains a wealth of untapped semi-structured and unstructured data.

Understanding data lakes and data fabric concepts empowers leaders to ensure that collected data are readily accessible and effectively utilized for decision-making. While insights typically align with descriptive analytics, leaders often rely on visualizations, such as dashboards built from structured data in data warehouses or lakes. For instance, units like the 3D Infantry Division collect massive amounts of data in a central data lake and extract insights through data fabric. This is an iterative process with a tremendous amount of experimentation that continues to evolve and build upon the data lake. Although these tools offer valuable insights, they may need to address the root cause of problems that diagnostic analytics can uncover. The true value of a unit lies in predictive and prescriptive analytics, enabling leaders to anticipate challenges and make informed decisions. By consolidating semi-structured and unstructured data from various sources in a centralized data lake and utilizing a data fabric, organizations can gain deeper insights, conduct complex analyses faster, and deploy machine learning algorithms more effectively to solve problems.

“The challenges that still exist are in delivering data and any associated models back to operational units because they have to make it to the data lake and back in mission relevant time. It is not sufficient to have a data lake that provides what the status of an aircraft was yesterday and so mission relevant time for the Warfighter Mission Area (WMA) is much sooner in most cases than in the Business Mission Area (BMA). Additionally, data lakes require a massive system to manage a lot of data sources

that most people will never use. This is why the data mesh and data fabric are vital. For those that need access to data most expediently, they will be able to connect to authoritative data at the nearest point of entry, which provides insight to units in mission relevant time and also prepares the Army for Disconnected, Denied, Intermittent, and/or with Limited bandwidth environments” (T. Dirienzo, personal communication, March 9, 2024).

Data lake houses represent a promising avenue for organizations to consolidate data storage, management, and analysis into a unified platform, offering scalability, flexibility, and analytical capabilities. While still in their early stages, these architectures enable efficient analytics across diverse datasets, integrating with modern data processing and analytics tools like machine learning and big data frameworks. By standardizing extract, transform, and load (ETL) processes, employing tools to handle various data formats, ensuring data quality through pipelines, and implementing efficient ETL solutions, organizations can establish robust data lake houses to support data-driven decision-making.

Conclusion

Culture, leadership, and data literacy are the biggest data and analytics maturity inhibitors. Recognizing the significance of becoming data-driven leaders and embracing data analytics is crucial for the overall effectiveness of Army Aviation operations. Data and analytics maturity doesn't start with technology; it ends there. By investing in data-driven leadership training and education, Army Aviation leaders can equip themselves with the necessary tools and knowledge to lead their organizations to greater success in today's rapidly evolving military landscape. The week-long DDL course is one of the best courses I have participated in throughout my career.

Data-driven leader program goals are to:

- Illustrate the potential of improved data-driven decision-making in various domains, including the Army investing in AI to achieve modernization goals.

- Describe how Enterprise data management (EDM) is essential to increasing the quality and reusability of data across the Army (Figure 3).

- Provide a comprehensive executive level understanding of EDM components and best practices. With a long wait list, most leaders will not have the opportunity to participate, so I hope that this article stirs something within readers, and I offer the following recommendations that anyone can implement:

- Model professional curiosity for your formation. While signing up to learn to code is not required, ask questions to learn more about the technical skills or processes required to execute your vision.

- Use the tools available to you and experiment with emerging technologies such as CamoGPT or Griffin AI. Operationalizing AI applications requires continuous utilization and feedback to scale. Demonstrating commitment at the top will go a long way to drive adaptation and prove value to an organization.

- Measure what matters. Start by saying, "I wish I knew" or "I wish I could," to determine where to start. That will help frame the problem for your team and reinforce a culture of top-down alignment and bottom-up refinement. Only when data are considered true, measurable assets, will necessary investment follow.

- Identify someone in your formation to serve in the Chief Data Officer role, reporting directly to the Commander. This acknowledges the importance of data, but more importantly, recognizes the

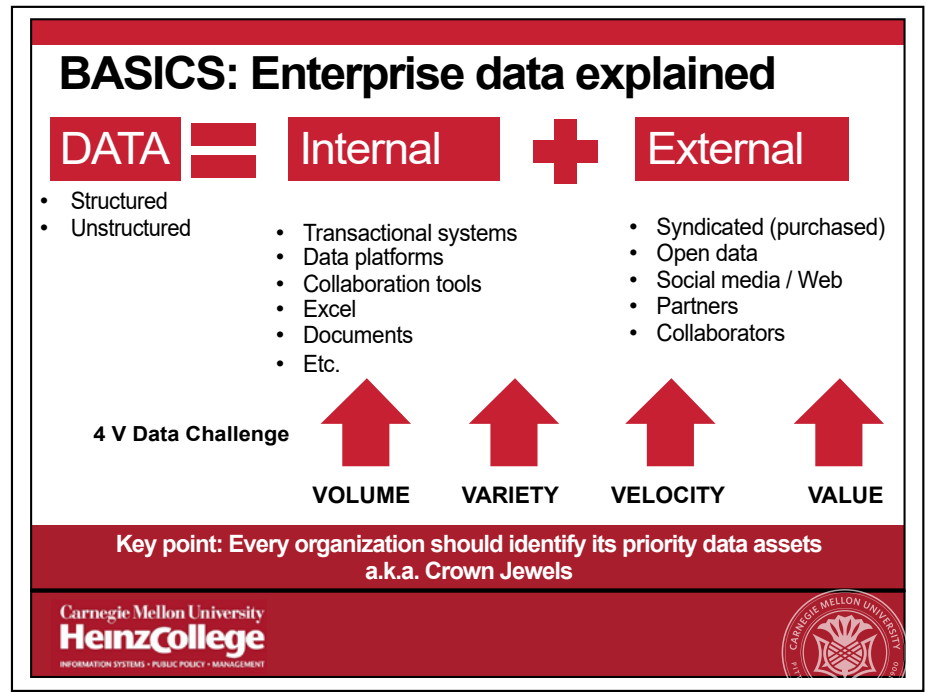


Figure 3. Basics: Enterprise data explained. Figure provided by Carnegie Mellon University, Heinz College, hosts of the Army DDL certificate program, 2023.

vital contributions of that one person in your formation, setting the tone and pace for digital transformation. That decision should be based on merit, not position. Then, connect them with appropriate personnel and resources at division and corps.

- Identify talent within your formations and empower them to drive change. Without designated data scientists in our formation or Operations Research/Systems Analysis (Functional Area 49) assigned to a brigade, units must fight with the team we have. Fortunately, the much lamented "experience gap" across aviation does not equate to a "talentgap" –this generation is far more talented and will continue to

surprise us if given a chance.

- Enablement of talent to pursue additional certifications in coding, analytics, and data science. Free courses are available to federal employees or the military from online learning platforms such as Udemy, the Federal Virtual Training Environment, and Coursera. Several public offering online learning platforms like Codefinity and EdX courses and programs are also available.

In conclusion, integrating data-driven practices is essential for the success of Army Aviation operations. This can only occur through the emergence of data-



Illustration courtesy of Pixabay.com

driven leaders and data-mature formations. Much like the Netflix series *Drive to Survive* (Webb et al., 2019), the digital transformation of our workplace will enable our units to plan, prepare, and execute with F1 precision. Achieving

this new reality requires better resource utilization, enhances situational awareness, and improves mission success that ultimately contributes to operational efficiency, safety, and effectiveness in the modern military.

Biography:

COL Ryan Sullivan is Brigade Commander of the 3D Combat Aviation Brigade. An AH-64A/D/E Aviator with multiple combat deployments, he is a former National Defense University (NDU) Scholar, who previously published his research on AI Competition between the U.S. and China for the Joint AI Center.



Illustration courtesy of Pixabay.com

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