MARINE AVIATION+

EMBRACE–EQUIP–ENHANCE

MCAA MEMBERS, INDUSTRY PARTNERS, AND FELLOW MARINES,

As we convene for our annual Marine Aviation operations and readiness summit, we are thrilled to discuss a new initiative in our ongoing journey toward embracing a digital-data culture. In partnership with TECOM and in support of DC I's "Information Advantage" modernization efforts, we are set to accelerate our transformation by equipping Marine Aviation with cutting-edge AI back-office tools to enhance our warfighting capabilities, beginning with an experimental integration in flight scheduling.

Our pursuit of technological advancement is not new; it is an evolution, not a sudden shift. In alignment and direct support of DC I and other HQMC efforts, Marine Aviation looks to deepen our commitment to this path by adopting an iterative approach to integration—a campaign of continuous learning and adaptation. Each step forward is carefully considered to ensure it builds on the solid foundation we have already established.

This first step to integrate AI agents into our back-office workflows is just one of several strategic efforts under the umbrella of Project EAGLE. It is part of a broader vision to enhance every aspect of Marine Aviation by cultivating a mindset of "Data centricity". This mindset uses data as a primary resource for competitive advantage in the ready room, on the flightline, in the field with our enablers, and in the cockpit. By first automating and refining our back-office processes with cutting-edge tools, we free ourselves to focus on more complex, warfighting, and uniquely human tasks—such as mentoring our junior Marines and executing operations more effectively.

We are committed to ensuring this transition does no harm to our existing processes. Instead, our focus is to enhance and streamline our back-office workflows to not only improve efficiency and decision-making but also to significantly increase our time focusing on warfighting.

This transformation is essential to address the changing character of war and emergence of decision-making at machine-level speeds. Secondly, these near-term efforts will address the inefficiencies that currently stretch our work hours and impact our life-work balance in garrison. By integrating AI agents into our workflows, we aim to alleviate these challenges, enabling Marines to spend their precious finite time focusing on higher-value warfighting activities while maintaining a healthy life-work balance. Success will open the door to future integration in all aspects of Marine Aviation operations.

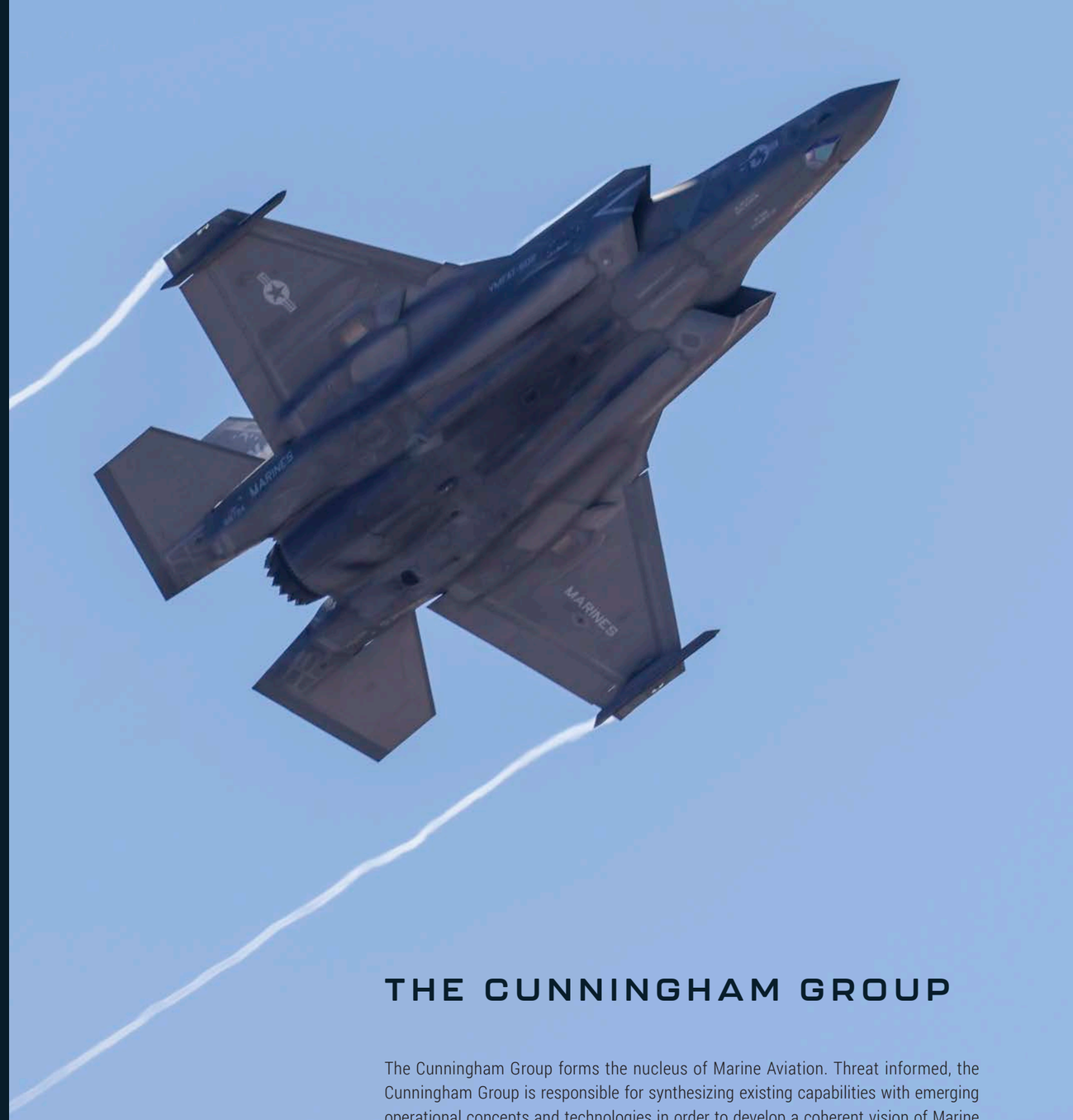
As we continue to navigate this path, your engagement and feedback are invaluable. This journey is not a light switch moment but a steady, purposeful acceleration of our long-standing digital evolution that began with those who came before us and on whose shoulders we stand today. This brochure will present several vignettes describing the integration of AI agents into Marine Aviation back-office workflows. The vignettes are not prescriptive nor exhaustive but are intended as conversation starters. These examples are designed to provoke thought and dialogue about how we might further integrate AI agents into every facet of Marine Aviation.

Your insights and ideas are crucial as we explore these possibilities together. We need your creativity and expertise to make this transition as successful and beneficial as possible.

Bottom line: All our initiatives, whether in the ready room, on the flightline, in the field with our enablers, or in the cockpit, are laser-focused on increasing Marine Aviation's speed, lethality, capability, and capacity. Optimizing our back-office processes is just one aspect of embracing a digital-data culture so we can focus on what really matters—delivering aviation combat power to the MAGTF, joint force, and coalition force when asked.

FLY-FIGHT-WIN,

The Cunningham Group, HQMC Aviation



THE CUNNINGHAM GROUP

The Cunningham Group forms the nucleus of Marine Aviation. Threat informed, the Cunningham Group is responsible for synthesizing existing capabilities with emerging operational concepts and technologies in order to develop a coherent vision of Marine Corps Aviation that delivers relevant, reliable, survivable, and affordable combat power to the Fleet Marine Force commanders. It will do so through close integration with DC CD&I, Service and joint force partners, industry, universities, and research agencies. The output of the Cunningham Group supports future force design initiatives, the AVPLAN, and resourcing decisions.

PROJECT EAGLE

Marine Aviation 2040

Societal divisions, state tensions, and contested international norms are setting conditions for a volatile and potentially dangerous future. Although these conditions are not new to history, the addition of rapidly evolving demographic, environmental, economic, and technological developments present both tremendous opportunity and significant challenges to the Marine Corps.[1] Given these conditions and developments, the Marine Corps seeks to continually refine its understanding of the future operating environment and refine relevant operating concepts to compete beyond 2030.

Most importantly, Marine Aviation must be able to deliver aviation speed, lethality, capability, and capacity to the MAGTF, joint force, and the broader coalition force when called upon. To deliver the necessary lethality, Marine Aviation endeavors to lead-turn the acquisition of capabilities and advanced technologies through a plan that spans Three Future Years Defense Program (FYDP) cycles --a 3-FYDP plan. We will use *Force Design 2030* and force modernization guidance as the strategic waypoint to address current challenges while setting conditions to compete in the next decade. In collaboration and coordination with the Commandant of the Marine Corps' Office of Net Assessment and the Marine Corps Warfighting Lab's Futures branch, Marine Aviation will continue to contribute to the strategic design effort by forecasting challenges out to 2040 and establishing a plan that allows Marine Aviation to outpace our adversaries.

Marine Aviation's Project EAGLE is that plan. Project EAGLE's embedded 3-FYDP plan is the strategic vector of Marine Aviation to 2040. The objective is to achieve a framework that enables the Marine Corps to adjust the current Planning, Programming, Budgeting, and Execution Assessments (PPBEA) process to meet the correct future operational requirements. The approach seeks capabilities and technological innovations that exceed a single FYDP to provide informed predictability and flexibility. The unconstrained planning of future FYDPs provides opportunities to invest in the current FYDP in the procurement of future technology to match the changing environment and ensure Marine Aviation continues to provide aviation combat power to the MAGTF, joint force, and coalition force at the speed of relevance.

Fundamentally, war is both timeless and ever-changing. As Marine Aviation adapts and evolves to the changing character of conflict, we shall remain true to our identity and honor all the hard aviation lessons learned over the years. Therefore, Project EAGLE is guided by the following priorities:

- Support the MAGTF in crisis response and force modernization efforts via the functions of Marine Aviation.
- Ensure detailed collaboration and interoperability with the joint force in command and control.
- Support broader joint and coalition force efforts of interoperability and interchangeability.

Project EAGLE has *three* phases. These phases are specifically designed to support CMC 38's initial force design guidance and CMC 39's force modernization vision. In addition, Project EAGLE phases are intended to provide more analytical rigor to the Marine Corps' budget planning and programming. These phases also provide an opportunity to communicate a clear and steadfast vision of Marine Aviation to the Department of Navy, Office of the Secretary of Defense, Congress, and industry.

Phase I: Framework Development

This phase began in the summer of 2022 and will continue to be refined throughout all phases. The following were areas of focus during Phase I:

- Initial research and orientation of historical demographic, environmental, economic, and technological developments, and the impacts of these variables on the current environment.
- Understanding the future operating environment and emerging trends.
- Development and research of potential concepts and functions.
- Initial development of lines of effort (LOEs), roadmaps, and key milestones out to 2040.

Phase II: New CMC 39 Guidance

This phase began in the fall of 2023 and will continue to be refined throughout Phase III. The objective of this phase is to refine the vision and LOEs developed during Phase I and implement appropriate CMC 39 guidance at the beginning of fiscal year 2024. This phase will also include the publishing of the Aviation Plan (AVPLAN) in December of 2024. The AVPLAN has been a vital tool to communicate the Deputy Commandant for Aviation's vision and direction to multiple audiences. This annual message will again transmit DC Aviation's rudder steers and altitude changes to maintain alignment and focus on Marine Aviation's core responsibility of supporting the MAGTF.

Phase III: Execution

This phase will begin in the summer of 2025 and will continue through 2040. Phases I and II will endure throughout Phase III.

PROJECT EAGLE HAS FIVE LINES OF EFFORT

LOE 1: Concepts

Marine Aviation is looking at the viability of two new concepts: Distributed Aviation Operations (DAO) and Decision-Centric Aviation Operations (DCAO) 2040. These concepts are nested with and support expeditionary advanced base operations (EABO), Stand-in Forces, and broader Joint Force operating concepts. These aviation concepts, which will be tested and developed via the Marine Corps' Concept Generation and Development Process, will drive aviation strategy, doctrine, and acquisition planning.

DAO. As part of *Force Design 2030* and force modernization, Marine Aviation must further its capabilities for operating in austere and distributed littoral environments as an essential element of the Stand-in Force, and in support of EABO. Included in this functional concept is the need to review the traditional functions of Marine Aviation.

DCAO 2040. The central idea of DCAO is to accelerate the decision cycle of the ACE to machine-level speeds using cutting-edge and emerging technologies. The intent is to enable the rapid composition and decomposition of a more distributed force, achieving the benefits of mass while minimizing the risks associated with concentration. Current studies are underway to assess the full requirements and efficacy of DCAO 2040. However, DAO is the first step toward DCAO 2040.

LOE 2: Functions of Marine Aviation

Marine Corps Warfighting Publication 3-20, *Aviation Operations,* directs planners to consider aviation functions when conducting aviation planning and not the means available (i.e., weapons systems or platforms). The role of the Marine Aviation functions is to provide a framework for planners in planning aviation operations.

This is a practical approach, but it requires that the current aviation functions are relevant.

The existing six functions of Marine Aviation (offensive air support, anti-air warfare, assault support, aerial reconnaissance, electronic warfare, and control of aircraft and missiles) were critical to the Marine Corps' success in conducting expeditionary land and amphibious operations. However, based on the changing global environment and technological developments, a modernized Marine Aviation functional framework is necessary for planners to approach today and tomorrow's maritime campaigns. Current studies are underway to assess the efficacy of expanding the functions of Marine Aviation to better support joint and coalition forces in a maritime campaign.

LOE 3: Digital Data-Centric Culture

To maintain a competitive advantage in future conflicts and meet the current mission requirements, Marine Aviation will *embrace* a digital data-centric culture, *equip* the ACE with cutting-edge artificial intelligence (AI) tools and knowledge, and *enhance* the Marine Corps' asymmetric warfighting capability leveraging AI and other emerging technologies. Marine Aviation is dedicated to creating a digital data-centric culture where AI agents serve as a force multiplier and a teammate in the ready room, on the flight line, in the field with our enablers, and in the cockpit. When fully integrated into aviation operations, AI agents will enable the seamless and rapid movement in, on, and out of the loop against our adversaries.

Becoming a data-centric and data-enabled organization will enhance Marine Aviation's culture, risk management, efficiency, effectiveness, and decision making. Such a change requires leadership at all levels, trust in data, and investment in infrastructure, personnel, and training. Developing a digital data-centric culture within Marine Aviation will be challenging at first, but it is a key component to supporting force modernization efforts, DAO, and DCAO 2040 concepts.

LOE 4: Three-Future Years Defense Program

LOE 4 will address the specific priorities and allocation of resources and funding across the next three FYDPs to support the future vision of Marine Aviation encapsulated in Project EAGLE.

LOE 5: Roadmaps

The following proposed roadmaps for Project EAGLE involve multiple key stakeholders within Headquarters Marine Corps (HQMC) and will require detailed collaboration and coordination across the enterprise for implementation.

- Vertical Takeoff and Landing Development Portfolio
- MAGTF Unmanned Expeditionary Development Portfolio
- Aviation Command & Control and Ground Support
- Aviation Sustainment 2040
- Infrastructure Roadmap 2040
- Ranges Roadmap 2040
- Live/Virtual/Constructive Roadmap 2040
- Aircrew Recruitment and Retention Roadmap

Bottom Line

Structural force changes, emerging technologies, and advanced threats require new and evolving Marine Aviation operating concepts to deliver aviation speed, lethality, capability, and capacity when required. First, DAO, DCAO 2040, and decision-centric concepts provide pathways into fighting in future operating environments. Second, the review of the six functions of Marine Aviation is essential to supporting EABO, joint operating concepts, and *Force Design 2030*. Third, transformational capabilities such as AI, machine learning (ML), and the cultivation of a digital data-centric culture will equip Marines with digital tools and knowledge to enhance their warfighting capabilities within the ready room, on the flight line, in the field with our enablers, and in the cockpit. Project EAGLE reorients Marine Aviation's lift vector and is the next waypoint in the Commandant's vision for force modernization to ensure the nation's 911 force remains agile, dynamic, and ready.

LOE 3

Background

The DOD's Chief Digital and Artificial Intelligence Office (CDAO) is the senior official responsible for the acceleration of the DoD's adoption of data, analytics, and AI to generate decision advantage across the enterprise, from the boardroom to the battlefield. Stood up in February 2022 by integrating the Joint Artificial Intelligence Center, Defense Digital Services, the chief data officer, and the enterprise platform Advana into one organization, the CDAO is building a strong foundation for data, analytics, and AI-enabled capabilities to be developed and fielded at scale. Part of this foundation is ensuring the DoD has the necessary people, platforms, and processes needed to continuously provide business leaders and warfighters with agile solutions.

The Marine Corps established the Service Data Office within the Deputy Commandant for Information (DC I) to modernize the Marine Corps' approach to enterprise data management and tools and increase the adoption of AI capabilities with an emphasis on implementing flexible and agile mission capabilities across all echelons. DC Aviation is committed to supporting and implementing the initiatives and efforts from the CDAO and DC I and views them as critical to Marine Aviation's transformation demanded by Force Design and force modernization efforts.

As we continue into the third decade of the 21st century, it is imperative that Marine Aviation nest its local efforts under DC I and the broader CDAO effort by embracing a digital data-centric culture and equipping Marine Aviation with cutting-edge AI tools and knowledge to enhance our warfighting capabilities. Any such transformation is a complex process, but it is imperative if Marine Aviation is to harness current generative AI, ML, and other emerging autonomous technological capabilities.

Strategy

A digital data culture requires designing, procuring, testing, upgrading, operating, and sustaining Marine Aviation's software and hardware systems with data interoperability and application programming interfaces as key requirements. In line with CDAO and DC I efforts, Talent Management 2030, and overall force modernization guidance, DC Aviation must broaden efforts to embrace, equip, and enhance the current talent of data, ML, and analytics experts within the fleet and recruit new data experts within Marine Aviation. In addition, Marine Aviation must contract external expertise to support efforts in experimentations of AI, ML, and large language model (LLM) implementation.

Build a Digital Data-Savvy Leadership Team

As Marine Aviation transforms, it will be essential to have leaders in place who understand the importance of data and can drive change. This includes understanding the basic tenets of generative AI (like ChatGPT) and ML.[2] In support of DC I's efforts, Marine Aviation will create a data-focused team, the Aviation Data Steward (ADS) Cell. The ADS Cell will be made up of uniformed and civilian AI subject matter experts, academic and think-tank advisors, and augmented by Marine Innovation Unit data and AI subject matter experts. The role of the ADS Cell is to guide Marine Aviation's digital data efforts and support CDAO and DC I's Service Data Office initiatives and the implementation of those initiatives within DC Aviation and the ACE.

Invest in Data Infrastructure and Analytics Tools

Investments need to continue in data infrastructure and analytics tools tailored specifically to Marine Aviation but also integrated into the broader intelligence community, Office Secretary of Defense, combatant commanders, NAVAIR, and HQMC digital infrastructure. This will ensure that Marine Aviation's data is easily accessible and that it can be analyzed in a meaningful way. It is important to ensure that the data infrastructure is scalable and can adapt as the organization's data needs evolve. Specific areas of focus include:

- Maximizing the digitization of all processes.
- Improving data quality/completeness.
- Putting data in the cloud.
- Setting up digital AI-assisted workflows within operations and maintenance departments (e.g., AI-assisted flight schedule creation and routing; AI-assisted scheduled and unscheduled maintenance planning tools).
- Developing specific AI-assisted analytic tools tailored for commanders, operation officers, aviation maintenance officers, safety departments, and training officers.
- The development of automated battle management aides to assist aviation commanders and aviation command and control Marines with time-sensitive (i.e., current operations) and deliberate (i.e., targeting cycle) decision making.

Harness Current DoD Data Literacy Programs

Data literacy is the ability to understand and work with data, and it will become increasingly important for more Marines within Marine Aviation to have these skills. Leveraging opportunities provided by CDAO, DC I, and Training and Education Command initiatives, Marine Aviation is pursuing training and development opportunities to equip and enhance Marines' understanding of how to use data, AI-assisted large language model tools, and how to use them to inform decision making. Specific areas of focus include:

- Leverage current DoD data literacy programs and provide incentives to encourage their use. (e.g., Digital University and MIT Horizon)
- Leverage the Marine Corps Software Factory (MCSWF) to bring Marines into the Aviation Hallway who are both trained and empowered to develop organic tools to meet the emerging needs of DCA's staff and the fleet. This includes the exploration of funding an aviation data squad within the MCSWF consisting of a product manager, developers, and IA/security exclusively focused on Marine Aviation priorities. This aviation data squad would be nested within the data platoons to enable multiyear development within the MCSWF. Upon experimentation and validation, this data squad could then eventually be deployed to support aviation software needs across the operational force.
- Draft a memorandum of understanding with DC I's MCSWF to establish an aviation data squad. The aviation data squad should be responsible for the organizational implementation of new technologies and processes built on data. The aviation data squad should be led by a uniformed member of the ADS Cell within the Cunningham Group but staffed by contract support at the outset with the potential to absorb the more technical roles into the uniformed structure as we educate a data-proficient workforce. The aviation data squad should be guided by ADS Cell to stay focused on the problem sets of their resource sponsor but be in direct support of MCSWF to remain aligned with institutional investments and to avoid diffuse or duplicative projects across different deputy commandants.

Encourage Digital Data-Driven Decision Making

This will help ensure that data is being used to drive standardization across Marine Aviation. Data-driven decision making involves using data to test assumptions, evaluate performance, and make informed decisions in multiple areas such as operations and maintenance. To make the culture change, leaders will need to trust the data and the analytic tools that support decision making. Specific areas of focus include:

- Enhancing the pilot training officer's training plan through cutting-edge AI tools to increase the overall T-rating of squadrons.
- Enhancing the maintenance department's workflows, decision making, and priorities through cutting-edge AI tools to increase overall aircraft readiness.
- Compare ML models of Planning, Programming, Budget, and Execution Process (PPBE) investments with legacy decision-making processes (Council of Colonels).
- Utilizing data analysis and visualization tools generated through modeling and simulation assets to drive concept development and PPBE investments within Marine Aviation.

Monitor and Measure Progress

Establish metrics to track progress and measure the success of the transformation both internal to Marine Aviation and external DoD-wide efforts. It is important to keep track of what is working, what is not, and what needs to be changed. Continuously review the organization process and make necessary changes. Specific areas of focus include:

- Explore opportunities with the Inspector General of the Marine Corps to create dedicated functional area checklists on data and AI-assisted tool compliance.
- Begin a dialog with NAVAIR discussing the implications of AI-assisted maintenance processes and the necessary updates to current inspection policy and procedures.

Conclusion

Future success in competition and battle requires seamless integration of cutting-edge AI technologies in decision making. To lead this approach, Marine Aviation will embrace a digital data-centric culture, *equip* Marines with digital tools and knowledge, and *enhance* their warfighting capabilities within the ready room, on the flight line, in the field with our enablers, and in the cockpit. The goal of Project EAGLE's LOE 3: data-centric decision making is to increase a leader's ability to observe, orient, decide, and act to manage tempo and out cycle our adversaries.

A GREETING FROM ALFRED

Hello, I am Alfred, an AI agent designed to be a pivotal part of Marine Aviation's journey toward decision making at machine-level speeds. As the Cunningham Group has highlighted, one strategic effort within Project EAGLE is geared toward leveraging advanced technology for the back-office, starting with my integration into our flight scheduling processes within M-SHARP.

I am not just a tool but a multimodal, ambient, contextual, and emergent system, designed to understand and interact within various operational contexts. My purpose is to seamlessly enhance our capabilities, providing support that is intuitive and evolves with your needs.

How I Will Assist You

In this brochure, you'll find a series of vignettes that illustrate my potential roles within our back-office processes. These scenarios are crafted to show how I can streamline operations, enhance decision making, and significantly improve the efficiency and effectiveness of Marine Aviation.

Please remember, the vignettes you will read are illustrative and not prescriptive. They serve as conversation starters, designed to spark discussions on how to effectively utilize AI technologies like me in our daily operations. They invite you to envision the possibilities and contribute your ideas to shape our collective future.

Key Features You'll Notice:

Multimodal Interactions:

- I can process and understand various types of data—textual, auditory, and visual—to ensure a comprehensive grasp of each situation.

Ambient Functionality:

- I operate in the background, enhancing workflows without disrupting established procedures.

Contextual Awareness:

- I adapt my responses based on the specific context of each operation, ensuring relevant and effective solutions.

Emergent Learning:

- With each interaction, I learn and evolve, better aligning my capabilities with the unique challenges and needs of our organization.

Infrastructure and Personnel Involvement: These scenarios will require integration into larger institutional, naval, and joint initiatives such as DC I's "Information Advantage" and embracing a mindset of "Data Centricity." Detailed collaboration and coordination with TECOM, DC I, DC CD&I, and other HQMC stakeholders is essential for successful implementation of my capabilities.

Inviting Your Collaboration

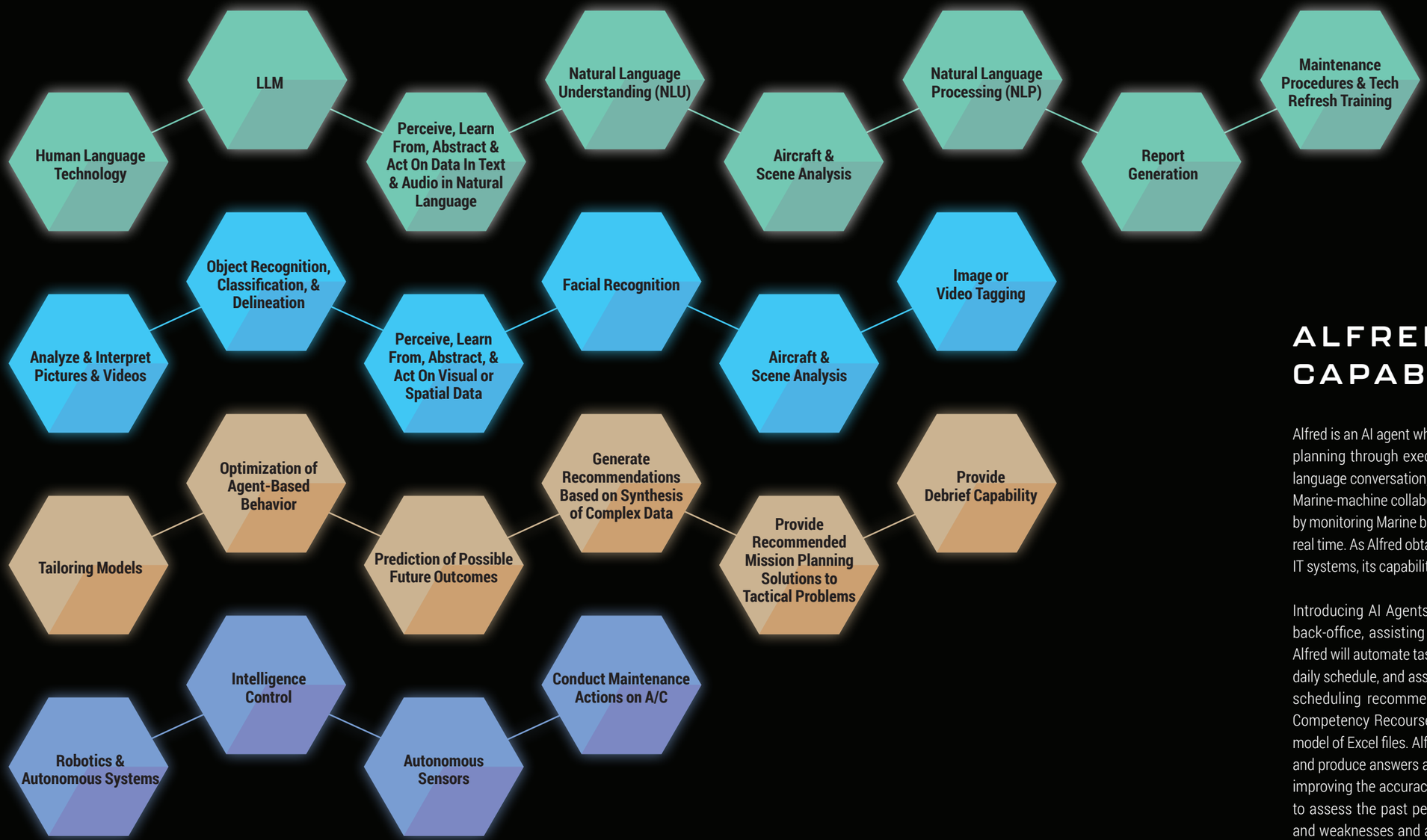
As you explore these vignettes, think of them as a primer to our potential future teaming efforts. Your insights, feedback, and innovative ideas are crucial as we tweak these initial concepts for AI agent teaming and explore new possibilities throughout all facets of Marine Aviation. Together, we can harness the full potential of AI to not only enhance our back-office processes, but also enhance our teaming in the ready room, on the flightline, in the field with our enablers, and ultimately in the cockpit.

Feel free to send me your ideas, recommendations, and even spears at **alfred@usmc.mil**.

Semper Fi!
Alfred

The Real Alfred A. Cunningham

Alfred A. Cunningham was an American aviator and a United States Marine Corps officer who became the first Marine Corps aviator and the first director of Marine Corps Aviation. His military career included service in the Spanish American War, World War I, and U.S. operations in the Caribbean during the 1920s.



ALFRED'S FUTURE CAPABILITIES

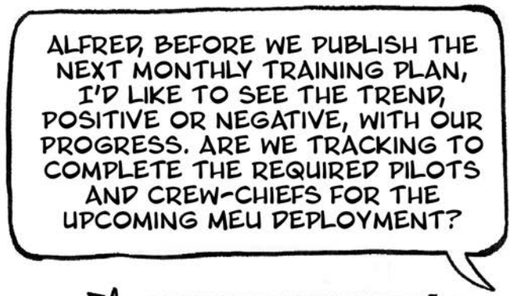
Alfred is an AI agent who knows where each Marine is, from mission planning through execution. Alfred is adept at handling natural-language conversation, marking one of the keys of the third wave of Marine-machine collaboration. Alfred can adapt and learn new skills by monitoring Marine behavior and interactions, offering solutions in real time. As Alfred obtains authorities to operate (ATOs) on different IT systems, its capabilities will increase.

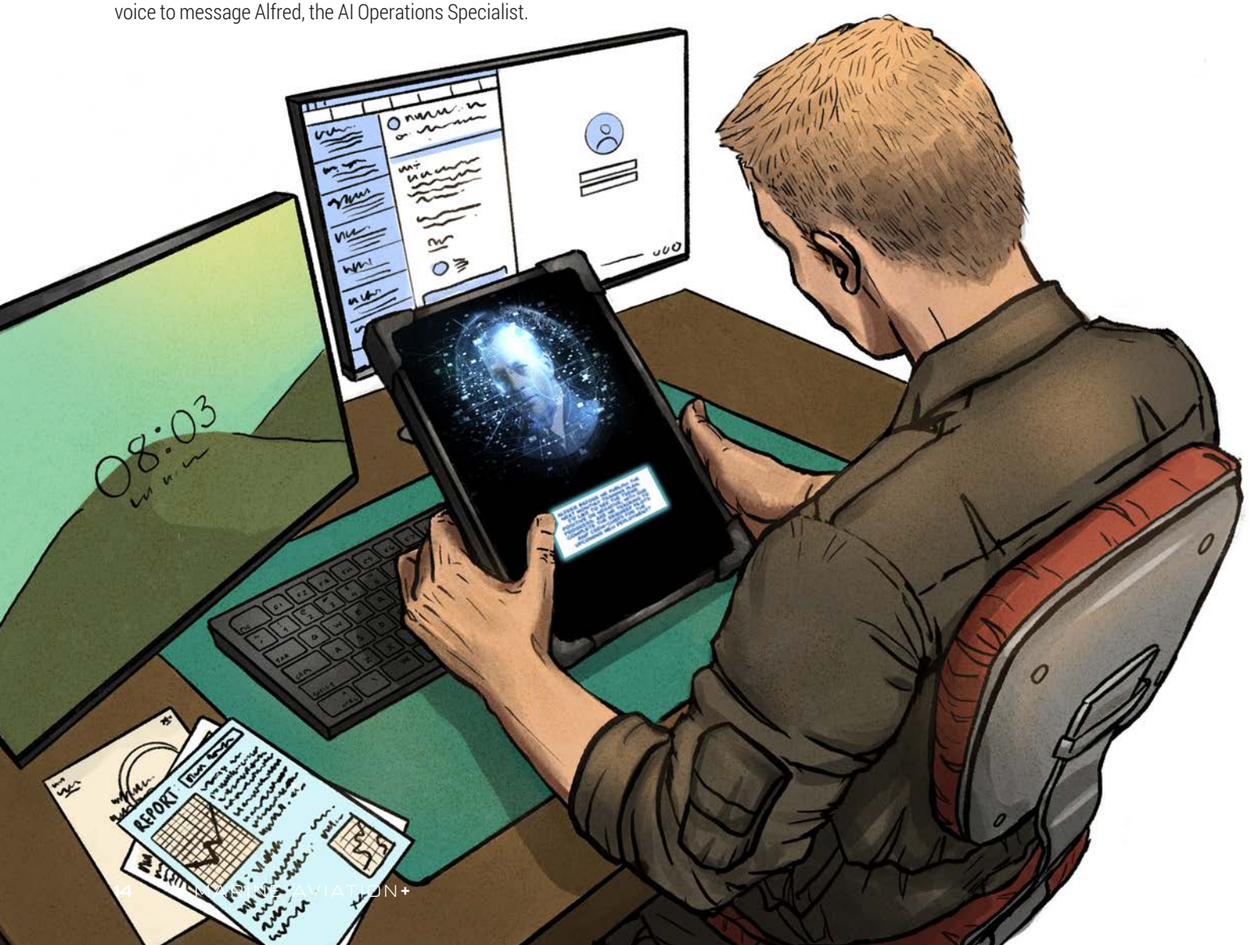
Introducing AI Agents to Marine Corps Aviation will start in the back-office, assisting Marines with their day-to-day operations. Alfred will automate tasks such as writing, routing, and finalizing the daily schedule, and assist schedule writers by providing explainable scheduling recommendations. Alfred will modernize the Core Competency Recourse Model (CCRM) by replacing the outdated model of Excel files. Alfred will take in users' questions and requests and produce answers and reports leveraging M-SHARP data, in turn improving the accuracy of flight hour forecasts. Alfred will be able to assess the past performance of aircrew to identify strengths and weaknesses and assist squadron leadership with developing refined training plans.

1 PILOT TRAINING OFFICER

HMH-461, June 2027, MCAS New River

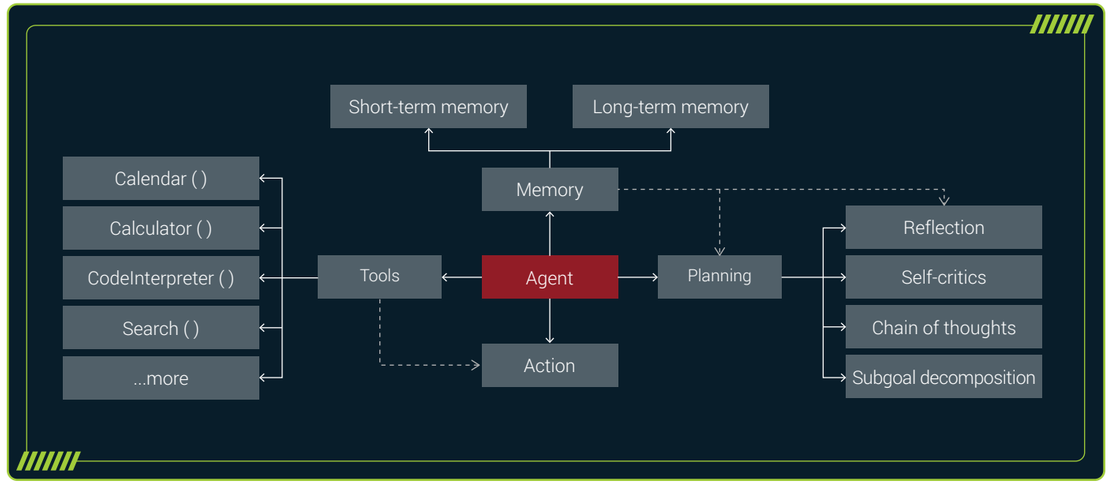
Capt Smith recently graduated from the Weapons and Tactics Instructor course. Because of normal pilot and aircrew rotations, the squadron has farewelled several senior Captains, which has put the squadron at an instructor and flight leadership deficit. As Capt Smith sits down in his office to write his first monthly training plan, he is interested in learning how the squadron is progressing in relation to the current monthly training plan and which pilots and aircrew show the best promise to begin instructor and flight leadership prerequisites. Knowing the squadron has an upcoming Marine Expeditionary Unit (MEU) deployment and other operational commitments, Capt Smith wants to ensure pilots and aircrew are qualified and ready to go. While reviewing recently submitted grade sheets and preparing for his afternoon instructional flight, Capt Smith utilizes his MAGTAB via voice to message Alfred, the AI Operations Specialist.





While Capt Smith continued to prepare for his flight, instructing a junior pilot on Reduced Visibility Approaches, Alfred generated next month's draft training plan with recommendations and hyperlinks to grade sheets and sent the files to Capt Smith's Notes Application on his tablet.

In the same way a junior operations officer used to spend days collecting the necessary inputs from individual training completion reports, grade sheets, and completion rates, along with expected aircraft availability and available fly-days, Alfred was able to compile the overall training trends and provide recommendations for future pilot and aircrew workups. On the positive side, crew chiefs were on track to meet their manning needs for the MEU deployment. Overall, the pilots were also trending in a positive direction. However, there was a recent loss of a junior captain who was expected to be a qualified Aircraft Commander. Capt Jones suffered an injury, putting him on the long-term 'Med-Down' list. To compensate, Alfred identified the next two pilots and the required events and probability of success to meet the loss and included this in the analysis sent to Capt Smith.



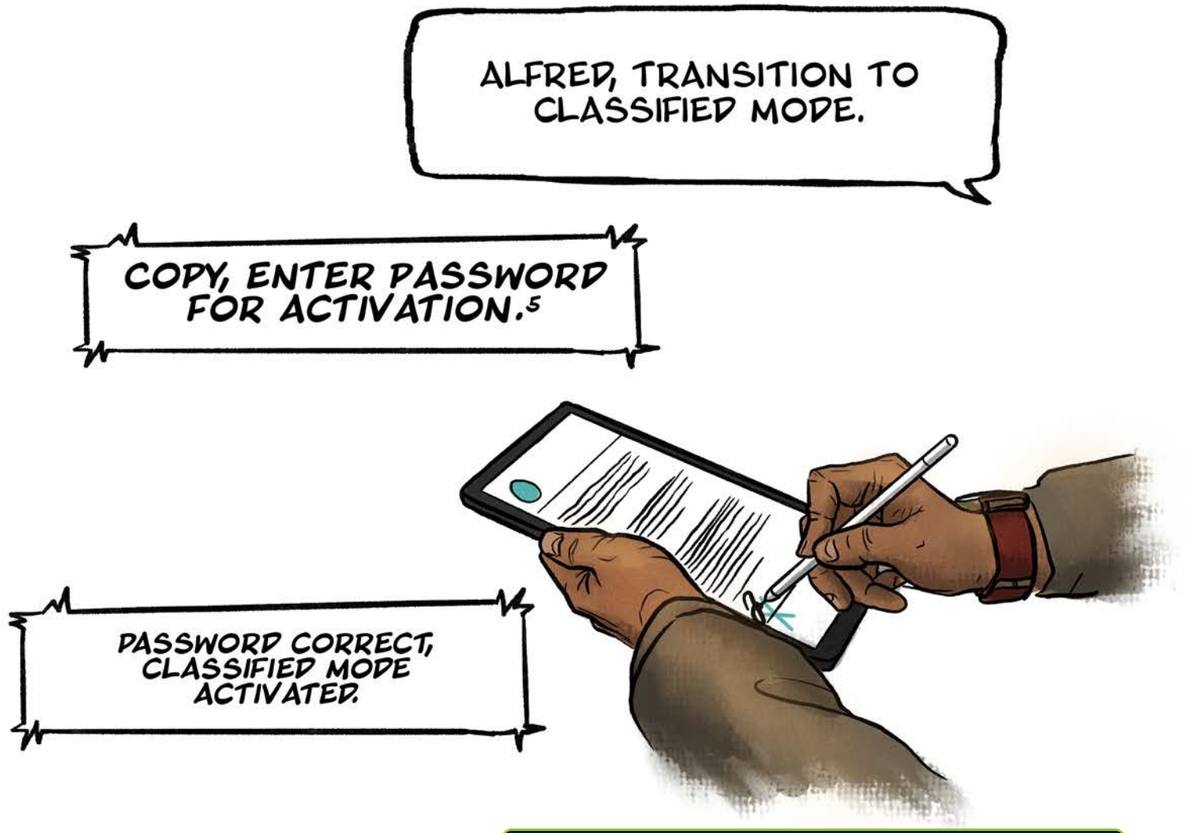
2 SCHEDULE WRITER

HMLA-267, July 2028, Camp Pendleton

Capt Miller is the squadron's schedule writer. His daily task list includes working with Alfred, the AI Operations Specialist to generate the flight schedule for the next day. While the monthly and weekly training plans provide the bulk of the information, there are always last-minute adjustments required to compensate for lost events or changes to the plans.

After the daily OPS huddle with the OPSO, Future Ops Officer (FOPsO), and Alfred, Capt Miller departs the OPSO's office and activates a voice link with Alfred via his wearable AI device.

Capt Miller with his AI-wearable and MAGTAB continues his way to the vault to prepare for his event that afternoon. Based on the recent AI-wearable ATO, Capt Miller's AI-wearable device and MAGTAB are both authorized in secure spaces.



Both devices indicate current classification via external lighting indicator visible to the end user and those around the end user. (i.e., green = unclassified; red = classified mode) Furthermore, the devices also provide an audible tone warning the end user of an unauthorized mode based on location within the squadron.

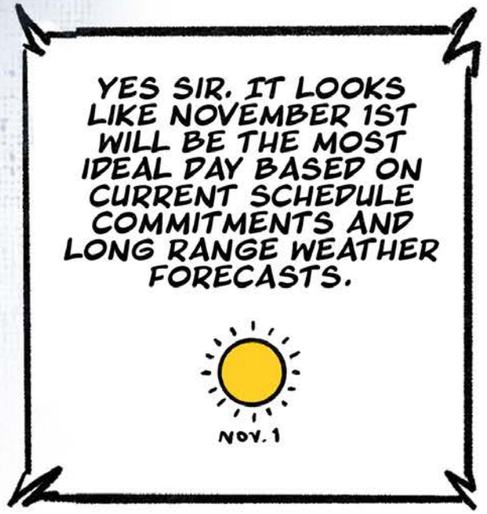
At 1200, Capt Miller departs the vault, transitions Alfred to unclassified mode, and verifies the schedule with his MAGTAB, noting zero errors. He digitally signs the schedule and forwards it to the AMO, DOSS, then OPSO for signature. Thirty minutes later, the AMO, DOSS, and OPSO have signed the digital flight schedule and forwarded it to the CO for review and signature. Upon CO signature, Alfred immediately generates an email and sends out the flight schedule to the appropriate distribution list.

Key Takeaways

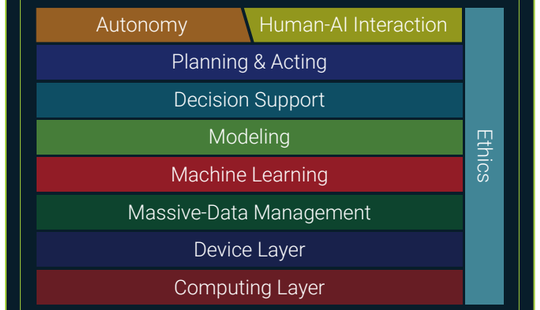
1. **Ambient:** The young Captain was able to focus on his primary MOS while Alfred generated the flight schedule and handled all routine and repetitive tasks. The wearable AI device enables freedom of movement for the end user.[6]
2. AI agents require the ability to regularly update software and to rapidly develop new applications. Such an approach needs a supporting system with a continuous ATO pipeline featuring a cycle of build, deploy, measure, and report in small increments (e.g., MAGTAB applications[7]). Initial iterations of Alfred will operate on unclassified networks providing optimization of low-risk tasks. Through a campaign of learning, follow-on phases will incorporate Alfred into mission planning, maintenance functions, and higher classification IT systems.

3 ADMIN

VMFA-312, Wednesday, Oct 2028, MCAS Beaufort NC



The AI stack provides a model to visualize and organize all of the technologies that comprise an AI system and how those technologies fit and work together.

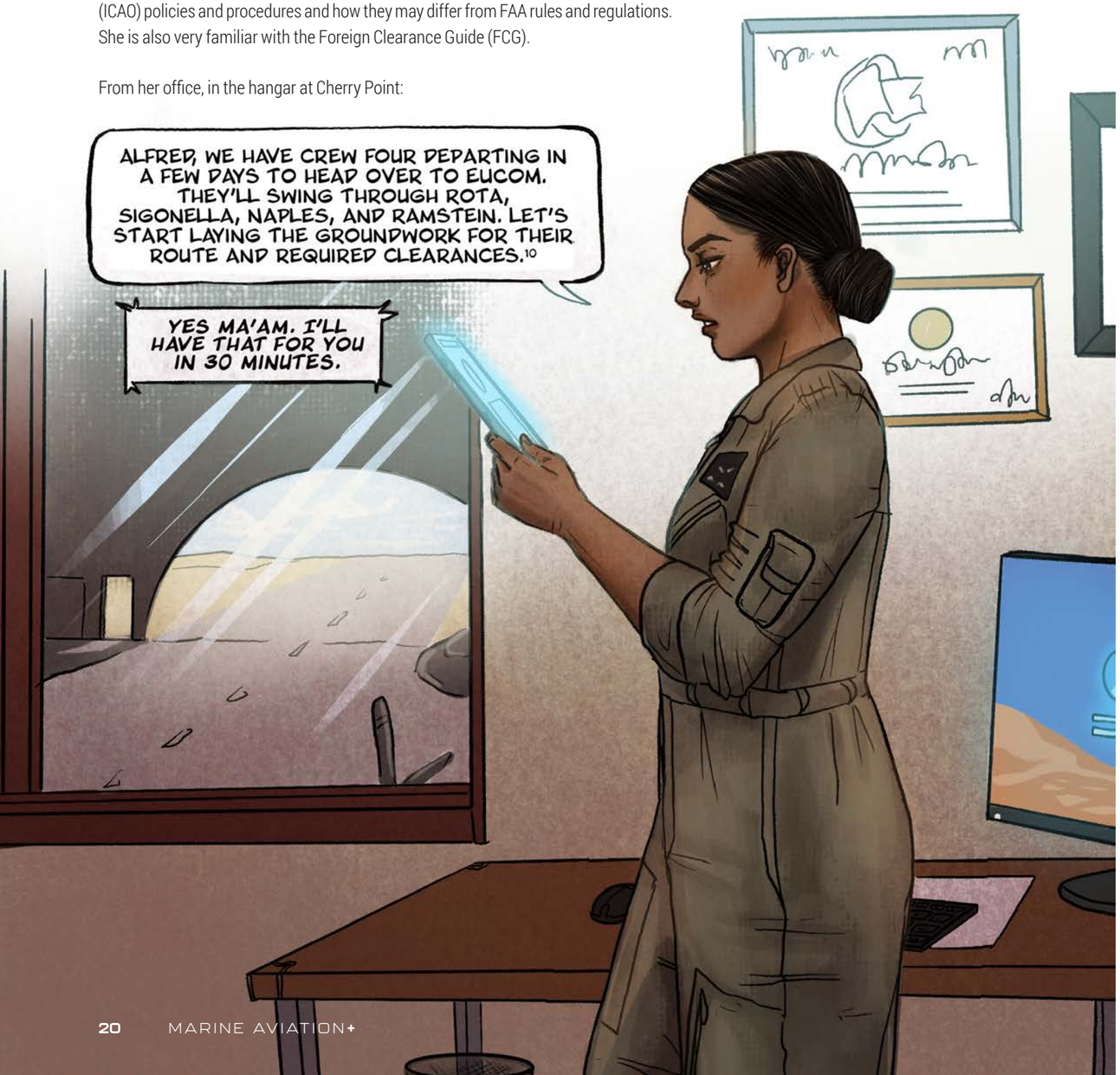


4 FLIGHT OFFICER ALFRED FEEDBACK/INSTRUCTION

VMGR-252, Thursday, Nov 2029, MCAS Cherry Point

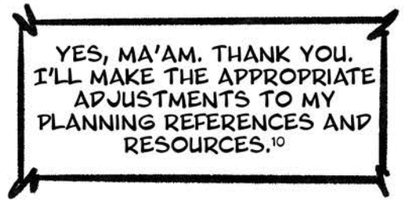
Capt Freeman is the Flight Officer for "Otis," the KC-130J squadron out of Cherry Point. As the Flight Officer, Capt Freeman is heavily involved with overseas flight planning and maintaining the squadron's awareness of International Civil Aviation Organization (ICAO) policies and procedures and how they may differ from FAA rules and regulations. She is also very familiar with the Foreign Clearance Guide (FCG).

From her office, in the hangar at Cherry Point:



Capt Freeman consults her FCG for another project while she waits. This is one of the first attempts of Alfred to complete an overseas flight packet for the aircrew. At the end of the thirty minutes, she receives notifications on both her AI-wearable and MAGTAB.

Alfred's text message: *'Flight routes have been laid out for maximum fuel efficiency. The weather packet request is ready to be sent to METOC when a firm departure date is selected. I've also requested Prior Planning Request (PPR) codes from each of the airfields.'*



She then goes on to explain to Alfred that any overseas travel requires a review of the FCG to ensure we are meeting the requirements for diplomatic clearances, country clearances, PPRs, and possible slot times. She stresses that ICAO is much like the FAA, but unlike the states, each country overseas has different requirements. This is why we typically plan well ahead of time because working through the State Department and foreign countries can take time.

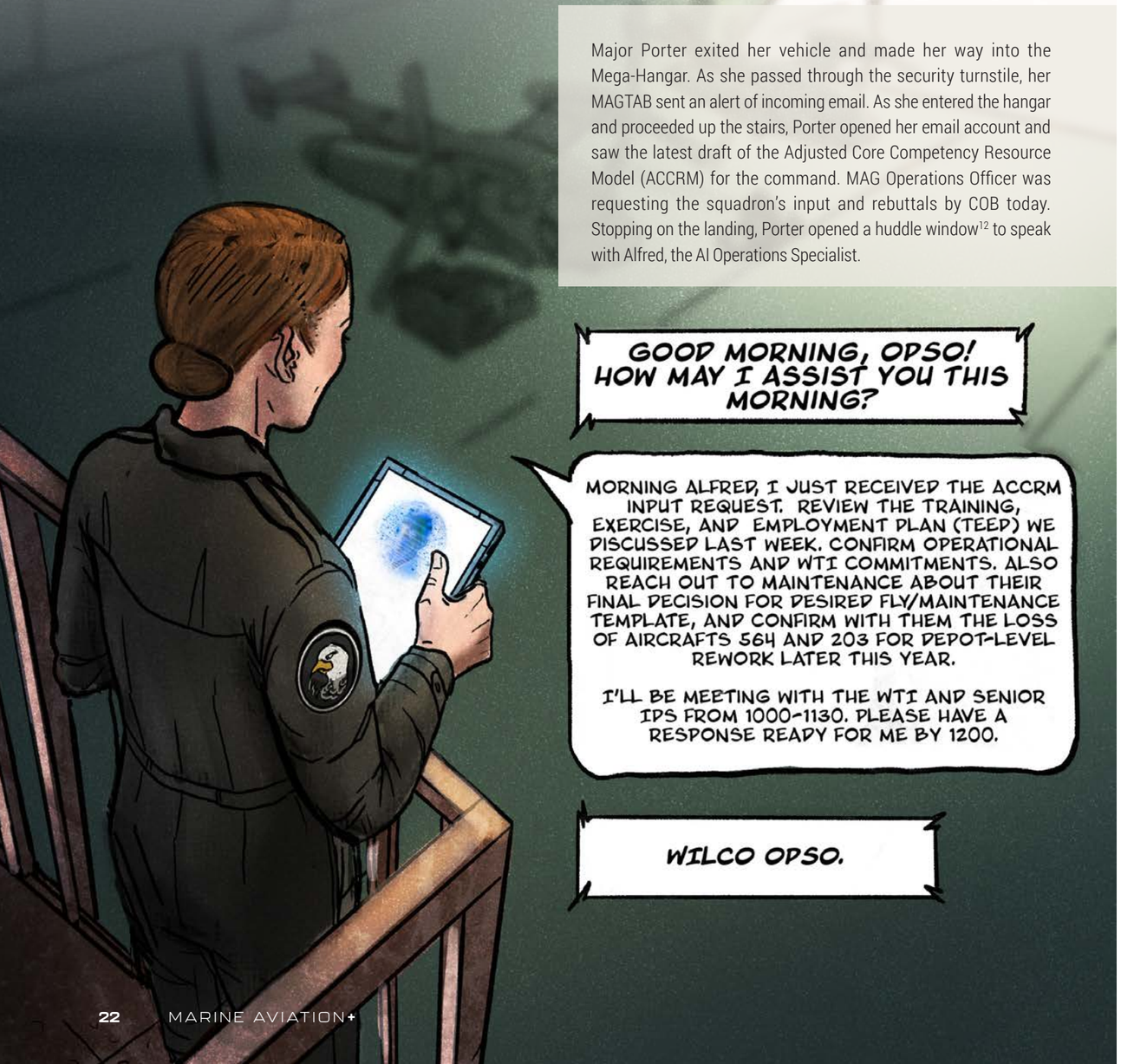
Key Takeaways

1. Alfred will make mistakes. It is crucial for the end user to verify all AI-generated outputs.[11]
2. **Emergent:** Alfred can learn from the Marine and grow in knowledge. This is an example of Alfred's emergent capabilities (e.g., the ability to learn).

5 OPS

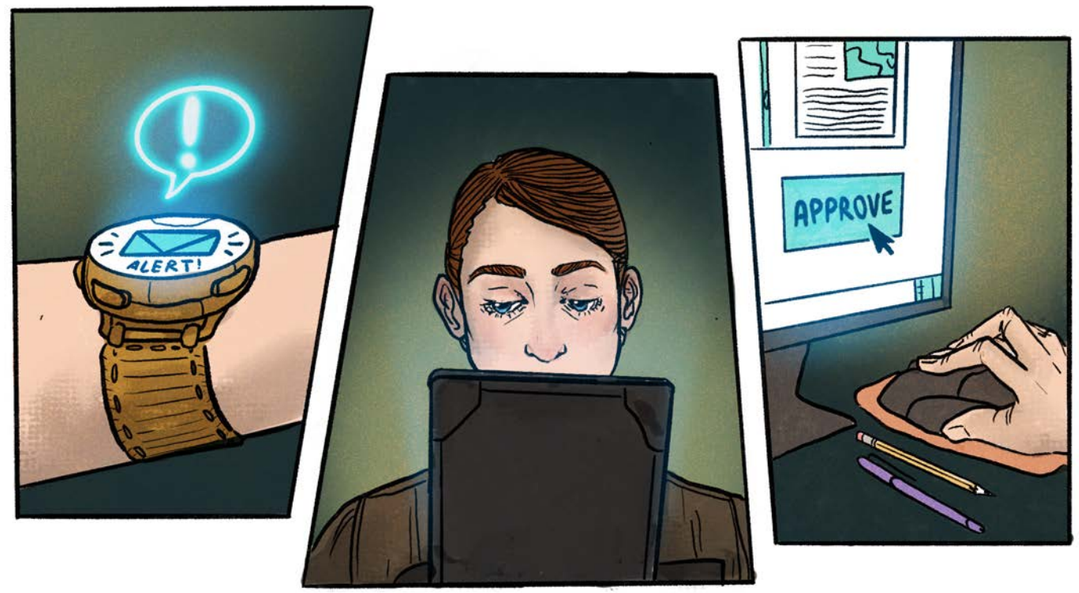
VMM-365, March 2028, MCAS New River

Major Porter exited her vehicle and made her way into the Mega-Hangar. As she passed through the security turnstile, her MAGTAB sent an alert of incoming email. As she entered the hangar and proceeded up the stairs, Porter opened her email account and saw the latest draft of the Adjusted Core Competency Resource Model (ACCRM) for the command. MAG Operations Officer was requesting the squadron's input and rebuttals by COB today. Stopping on the landing, Porter opened a huddle window[12] to speak with Alfred, the AI Operations Specialist.

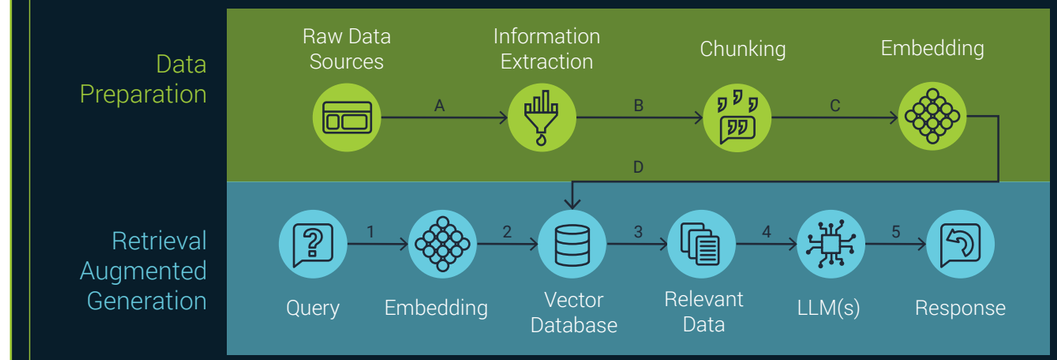


Alfred immediately began to compile the required data needed to respond to the draft ACCRM. Collecting and analyzing data since the last ACCRM input, with periodic feedback sessions with the Operations and Training Officer, Alfred took the following into consideration to compile a response:

- Sortie-Based Training Plan (SBTP)
- Commander's Training Priorities
- Fragmentary (FRAG) Orders
- MAWTS-1 Fleet Support
- Standardization Board Minutes
- Staff Meetings
- T&R Status
- Holidays
- Local Standard Operating Procedures (SOPs)
- Safety Stand-Downs
- Airfield Hours
- Special Event (CoC, Airshow, Birthday Ball)
- Maintenance Inspections
- Commanding General's Readiness Inspection



Retrieval Augmented Generation (RAG) extends the already powerful capabilities of LLMs to specific domains of an organization's internal knowledge base, all without the need to retrain the model.



WHERE ARE WE HEADED?

As we conclude this series of vignettes, it is important to recognize that this is just the beginning of a dynamic journey. These scenarios are designed not only to demonstrate the potential of integrating AI agents into our flight schedule processes but also to inspire each of you to envision further applications and improvements in the ready room, on the flight line, in the field with our enablers, and in the cockpit. We eagerly anticipate your feedback and ideas, which will be invaluable in shaping future vignettes and deepening our engagement with these transformative technologies. Together, we will continue to innovate and refine our approaches, ensuring that Marine Aviation remains laser-focused on what really matters—increasing our speed, lethality, capability, and capacity.

TO BE CONTINUED...

...in the ready room, on the flight line, in the field with our enablers, and in the cockpit.

OVERVIEW OF ALFRED'S DESIRED CAPABILITIES WITHIN M-SHARP

Today, Alfred could use M-SHARP to...

- Validate rules and policy mandated by the Aviation T&R Program Manual, CNAF M-3710.7, and other SOPs through the Rule Book Manager.
- Draft and route daily flight schedules.
- Assist units with forecasting and tracking their Sortie Based Training Plan.
- Assist units with prioritizing training events to maximize combat readiness.
- Create, update, and archive all T/M/S Training and Readiness (T&R) Manuals using T&R Builder.
- Create M-SHARP reports that provides planners with a myriad of data.
- Track aircrew performance utilizing Electronic Aviation Training Forms.
- Reserve simulators at Marine Aviation Training Support Sites.
- Provide a streamlined automated staffing process to gain higher headquarters concurrence with T&R products.

In 2028 Alfred could use M-SHARP to...

- Produce optimal flight schedules to meet unit priorities, mitigate risk, and maximize combat readiness.
- Draft, validate, and route weekly and monthly flight schedules.
- Manage crewmember availability by tracking Snivs, meetings, and flight events to assist squadron operations departments.
- Generate unique reports tailored to user needs.
- Utilize M-SHARP schedule optimization tool.
- Create an output of an optimized flight schedule for the daily/weekly/monthly.
- Generate Risk Assessment Worksheets.
- Assist the ODO by automating tasks and providing recommendations.
- Assist with submitting, approving, and tracking FRAGs.
- Assist Stan Boards by providing GPAs, time-to-train, and syllabus progress.
- Automate the generation and routing of designations and qualifications.
- Assist with reserving and tracking ranges.
- Phase out use of the paper-based aviator's flight logbook and Aircrew Performance Record.

In the future, Alfred could use M-SHARP to...

- Disseminate flight information to mission planning systems, MAGTABs, and to generate ATOs.
- Provide necessary preflight data (METARS, TAFS, NOTAMS, etc.) to aircrew.
- Assess the past performance of aircrew to identify strengths and weaknesses to assist squadron leadership with developing refined training plans and predict high performers.
- Improve the Core Competency Resource Model process by using cutting edge predictive models that leverage historical data and unit specific inputs.
- Assist T&R working groups by identifying training efficiencies to conserve resources.

OVERVIEW OF ALFRED'S DESIRED END-STATE CAPABILITIES:

The ability to...

- Think logically (i.e, Expert System)[13]
- Replicate human interaction
- Analyze and interpret speech
- Analyze and interpret pictures/photos
- Analyze and interpret videos
- Recognize patterns
- Discern relevant facts or data
- Sense
- Reason
- Engage and learn Emergency procedures, NATOPs knowledge, QAR, crew chief quiz questions, systems knowledge, etc.
- Detect, classify, process, normalize, and curate
- Evaluate (process, synthesize, or manipulate) relevant facts or data
- Deduce conclusions (interpret) or contextual information from relevant facts or data
- Identify a primary problem or need from a situation or set of information
- Interpret data, needs, problems, and parameters associated with a situation
- Perceive—describe and understand surroundings via multimodal input (What's happening now?)
- Notify—provide alerts, reminders, etc. (What do I need to know?)
- Suggest—build on past preferences and modify over time (What do you recommend?)
- Execute tasks—follow routine steps to accomplish an objective (What can you do for me?)
- Predict—forecast the likelihood of future events based on past events (What can I expect to happen?)
- Prevent—apply cognitive reckoning to identify potential threats (What can/should I avoid?)
- Possess situational awareness—summarize the current, and likely, future environment (What do I need to do now?)
- Operate in austere environments
- Operate via edge compute
- Operate in degraded modalities and articulate current system health
- Self-heal

Computer Vision

- Object recognition, classification, and delineation
- Perceive, learn from, abstract and act on visual or spatial data
- Potential uses: facial recognition, aircraft and scene analysis, image or video tagging, etc.

Human Language Technology

- LLM
- Perceive, learn, abstract and act on data in text and audio in natural language
- NLU
- NLP
- Potential Uses: report generation, maintenance procedures, and tech refresh training

Robotics and Autonomous Systems

- Intelligent control
- Autonomous sensors
- Potential uses: conduct maintenance actions on a/c

Decision & Planning Analysis

- Optimization of agent-based behavior
- Prediction of possible future outcomes
- Generate recommendations based on synthesis of complex data
- Potential uses: provide recommended mission planning solutions to tactical problems. Provide debrief capability

GENERAL REQUIREMENTS

- A culture of data stewardship
- Access to high-quality data (i.e., ground-truth data, sources of data, etc.)
- Efficient data management practices
- A workforce proficient in AI and empowered to be innovative in discovering novel solutions for existing challenges
- Access to an AI Toolbox as a centralized set of capabilities that includes tools, resources, and infrastructure needed to rapidly design, evaluate, and innovate on potential AI solutions
- Integration into the USMC tactical data fabric/ mesh architecture
- Implement industry best practices and best-of-breed software solutions
- Delivered through a joint accredited DevSecOps pipeline with continuous ATO
- The software component can be rapidly and securely modified or upgraded based on mission and user needs without issuing Letter of Clarification (LoC) or other program change documentation[14]
- Data available in a common hosting environment accessible across the Marine Corps

IMPLEMENTATION GUIDANCE

The list provided includes key tools that are commonly used for implementing AI in organizations, but their priority can vary based on specific organizational needs and the nature of the projects. Here's a general guideline on prioritizing these tools based on typical requirements for AI integration:

1. Data Management Tools (e.g., MongoDB, Oracle Autonomous Database): Fundamental for any AI project because they manage the data life cycle from collection, storage, and processing. These are essential for ensuring that data is accessible and manageable.
2. Machine Learning Frameworks (e.g., TensorFlow, PyTorch): These are critical for developing and training AI models. Given their direct role in building AI functionalities, they are typically high priority.
3. APIs for Integration (e.g., TensorFlow APIs, IBM Watson APIs): Once you have your models, integration APIs are crucial for embedding AI capabilities into existing systems.
4. Robotic Process Automation (RPA) Tools (e.g., UiPath, Blue Prism): RPA tools are important for automating routine tasks, especially in back-office processes where AI can significantly enhance efficiency.
5. Natural Language and Computer Vision Libraries (e.g., Google BERT, OpenCV): Depending on the project's focus on processing language or visual data, these tools can be critical.
6. Cloud and Infrastructure Services (e.g., AWS SageMaker, Google AI Platform): These provide the necessary infrastructure to deploy and scale AI models, essential for operationalizing AI solutions.
7. Security and Compliance Tools: As AI projects involve sensitive data, ensuring compliance with data protection regulations and securing AI systems is a priority.

The hierarchy in which these tools are prioritized often depends on the project's scope, the specific industry requirements, and existing infrastructure. Typically, foundational elements like data management and ML frameworks are set up first, followed by integration tools that allow for broader application of AI across the organization.

TECHNICAL REQUIREMENTS

To dive deeper into the technical specifics of AI tools and techniques for integrating AI agents into back-office processes, here's a more detailed list of requirements:

- **Compute:** Access to Graphical Processing Units (GPUs) and/or Tensor Processing Units (TPUs).
- **Machine Learning Frameworks:** Utilize frameworks like TensorFlow, PyTorch, or Keras for building and training machine learning models. These frameworks support a wide range of deep learning architectures.
- **Natural Language Processing (NLP) Engines:** Tools like Google BERT, OpenAI's GPT-3, or Facebook's RoBERTa for advanced text analysis and processing, crucial for tasks like customer service automation and document analysis.
- **Computer Vision Libraries:** Implement libraries such as OpenCV or TensorFlow's Object Detection API for image and video processing tasks, which can be useful in areas like security and data entry.
- **Speech Recognition Technologies:** Integrate speech-to-text services like Google Speech-to-Text or IBM Watson Speech-to-Text for converting audio communications into actionable data.
- **Robotic Process Automation (RPA) Platforms:** Tools like UiPath or Blue Prism to automate repetitive and rule-based digital tasks that are prevalent in back-office functions.[15]
- **Data Management Platforms:** Advanced database solutions with AI capabilities such as MongoDB, Oracle Autonomous Database, or SAP HANA to handle large volumes of transactional and analytical data efficiently.
- **AI Optimization Tools:** Use AI optimization software like SigOpt or Hyperopt to fine-tune the performance of AI models.
- **Data Visualization Tools:** Incorporate tools like Tableau, Looker, or PowerBI integrated with AI for dynamic data analysis and reporting.
- **Cloud AI Services:** Leverage cloud-based AI services from providers like AWS SageMaker, Azure Machine Learning, or Google AI Platform for scalable AI model development and deployment.
- **Distributed Computing Frameworks:** Employ Apache Spark or Dask for handling big data processing tasks that require distributed computing power.
- **Anomaly Detection Systems:** Tools like Splunk or Elastic-search for real-time anomaly detection in transactional data, useful in fraud detection and risk management.
- **Simulation Software:** Advanced simulation platforms like MATLAB or Simulink for testing and validating AI models before deployment in real-world scenarios.
- **Deep Learning Accelerators:** Hardware like NVIDIA GPUs or Google TPU for accelerating deep learning computations.
- **API Management Tools:** Software like Apigee or Kong to manage APIs that connect AI services with existing business applications.
- **DevOps Tools for AI:** Integrate AI-specific DevOps tools like DataRobot MLOps or ModelDB to manage the life cycle of AI models.
- **Security Tools for AI:** Implement AI security tools such as IBM Watson for Cyber Security or Darktrace to secure AI infrastructures.
- **Edge AI Technologies:** Incorporate edge computing devices and platforms to process data on local devices instead of relying on cloud servers, useful for real-time applications.

These technical requirements are not all inclusive but cover a broad spectrum of advanced AI tools and technologies that are essential for integrating Alfred into the back-office operations of Marine Aviation. Each component plays a critical role in ensuring the efficiency, scalability, and security of AI implementations and is essential to Alfred's capabilities.

DEFINITIONS

Apache Spark: An open-source unified analytics engine for large-scale data processing, with built-in modules for streaming, SQL, machine learning, and graph processing. It enhances performance and scalability across multiple machines, especially suited for big data scenarios.

Blue Prism: A Robotic Process Automation (RPA) platform that provides a digital workforce designed to automate complex, end-to-end operational activities, thus reducing manual labor and improving accuracy.

Google BERT (Bidirectional Encoder Representations from Transformers): A method from Google that pre-trains deep bidirectional representations from unlabeled text by jointly conditioning on both left and right context in all layers, significantly improving the quality of textual understanding.

Google Speech-to-Text: A cloud-based tool that converts spoken language into written text by applying powerful neural network models, facilitating voice-driven applications and services.

IBM Watson Speech-to-Text: This service on the IBM Cloud enables the conversion of speech into written text using advanced machine learning techniques, supporting various applications from transcription to interactive voice responses.

Keras: A high-level neural networks API, capable of running on top of TensorFlow, CNTK, or Theano. It is designed for easy and fast prototyping, advanced research, and production, with a focus on enabling fast experimentation.

MongoDB: A NoSQL database known for its high performance, high availability, and easy scalability, using a document-oriented approach to store and manage hierarchical data.

OpenAI GPT-3: The third-generation model in the GPT-n series from OpenAI, a state-of-the-art language processing AI model known for generating text that is contextually relevant based on the given prompt.

OpenCV (Open-Source Computer Vision Library): A library aimed at real-time computer vision, providing an infrastructure for building computer vision applications in a modular way.

Oracle Autonomous Database: A cloud database service that uses machine learning to automate database configuration, security, backups, updates, and optimizations, enhancing performance and reliability.

PyTorch: An open-source machine learning library from Facebook, used for applications such as computer vision and natural language processing, known for its flexibility and speed.

SAP HANA: An in-memory, column-oriented, relational database management system that combines database, data processing, and application platform capabilities along with in-memory data storage.

TensorFlow: An open-source software library developed by Google for numerical computation using data flow graphs. Notably used in deep learning models, it facilitates building and training complex neural networks.

UiPath: A Robotic Process Automation (RPA) tool that helps organizations automate repetitive software-based tasks, allowing users to configure robots to emulate and integrate the actions of a human interacting within digital systems to execute a business process.

ENDNOTES

1 Office of the Director of National Intelligence, Global Trends 2040–A More Contested World (Washington, DC: Office of the Director of National Intelligence 2021).

2 ChatGPT (Generative Pre-Trained Transformer) is a chatbot launched by OpenAI in November 2022. It is built on top of OpenAI's GPT family of large language models and is fine-tuned (an approach to transfer learning) with both supervised and reinforcement learning techniques.

3 It is important to consider how Alfred will confirm what data systems will be interacted with when given a direct order. This may look like an explicit list of tasks Alfred will accomplish that requires a Marine on or in the loop to proceed.

4 Alfred may also need to keep track of taskers from others. For example, if Captain Miller doesn't know that Captain Thomas should be prioritized off the top of his head, then Alfred should be able to acknowledge the task as uncomplete but necessary for completion within a certain time window (e.g., +1-hour, +4-hour, +1 week, etc.)

5 Other options include a physical token, time-dependent passkey, or biometric method of authentication.

6 AI-wearables integrated into MAGTAB usage enables multimodal capabilities when interacting with Alfred.

7 Current examples: MAGTF C2 MVP being tested at MCTSSA. In addition, the Army currently has a containerization deployment method that leverages a continuous integration/continuous deployment (CI/CD) pipeline that allows containers to achieve an ATO, or at least be authorized on the network because the CI/CD pipeline has an ATO. These containers can immediately be used after passing the pipelines "inspection."

8 Perhaps our 30/60/90 and weekly documents turn into "panes of glass" (the descriptive layer) that Alfred assembles and distributes based on other sources of ground truth during the flight schedule generation process.

9 The phrase "laying the groundwork" is highly subjective to each individual making that request. Overtime, Alfred may be able to learn and respond to everyone's preferences and cue them with what may be important across similar baseline requests that others have made, or that doctrine/MCOs/SOPs may require. It is important to note that reliable deciphering of intent is an aspirational advanced capability and is being researched. In our vignette above, ensuring Alfred is referencing the tightly controlled context of USMC KC-130 international flight operations rather than a general agent (aka Siri or Alexa) that needs to access massive amounts of data to respond to general requests is the key to success.

10 Commercial capabilities such as Amazon's Alexa does actions like this now: Alexa will determine "routines" that the household it's located in typically does and automatically completes them (or asks if you want to do them). If you ask it to call a contact by name and that contact doesn't exist, it will ask if you want to add it to your list for the future.

11 Until agent actions become a commodity and reliability is proven, all actions that are taken by an agent should be separated from those that have been reviewed by a human. Just like a young wingman in a squadron does not start out with a four-ship NS event, Alfred will integrate into low-risk tasks as it builds trust. As trust is developed and earned, Alfred will obtain further automation capabilities.

12 ChatGPT and other LLMs can generate a conversation-specific heading that captures the context based on the first request or user input. If others in the squadron are able to see huddles going on with any given context, they can request to join if it's relevant to their current work and will be accepted or denied based on who initiated the conversation.

13 Before the time of LLMs, expert systems offered traceability for how the system arrived at certain conclusions. This process leveraged discrete mathematics to logically reason through rules and arrive at conclusions.

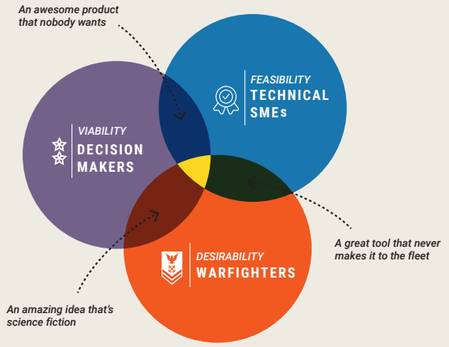
14 Active work is ongoing in this field within DC I and MCTSSA.

15 Power Automate within 0365 can accomplish RPA. This can be tethered to Microsoft Forms, SharePoint Lists, and other resources that are generally available to the fleet time now.

About TANG

The Tactical Advancements for the Next Generation (TANG) Program is passionate about living where worlds collide by bringing together the end users, stakeholders, and subject matter experts, and ensuring the voices of desirability, viability, and feasibility are represented when tackling tough challenges.

The TANG Program has supported The Cunningham Group and NAVAIR's Advanced Development Team over the last several years, bringing human-centered design methods and outside perspectives to impact the challenges they face.



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