Marine Air Command and Control System

Adapting to the information environment

by Capt Daniel Tadross

Future Operation DAWN BLITZ. Air operations are ongoing, and a company air assault is being planned after multiple days of air strikes and surface fires. Agencies within the Marine Air Command and Control System (MACCS) are working to aggregate various streams of data on the last days of operations from intelligence, surveillance, and reconnaissance; battle damage assessments; artillery mission information; and electro-magnetic collections as well as integrating with intelligence gained from a recent raid or an enemy safehouse where a trove of documents, bank records, and telephone numbers were collected.

Within each squadron a portion of the data collected is transformed into useful information by utilizing narrow band artificial intelligence. The newly acquired information is transmitted from the subordinate agencies of the direct air support center and tactical air operations center to the tactical air coordination center (TACC). The information received is combined with further context, as well as pattern of life analysis and social media collections across the entire area of operations, to transform information into actionable knowledge for the commander to build an inclusive plan based on the current environment.

Based on data and the method of integrating narrow artificial intelligence (AI) and human creativity, insights are gained on the enemy situation and their probable future courses of action (COAs). As a result, the objective and composition of the company air assault is changed to exploit the newly perceived enemy scheme of maneuver, creating an accurate plan based on the evidence and insights gained by combining the full spectrum of data available.

>Capt Tadross is assigned to the Office of the Deputy Under Secretary of the Navy (Management).

The Marine Corps must leverage narrow band AI to create real improvements in its operations and processes, particularly if it is to adequately address the new challenges of tomorrow's battlespace. This is especially true in the realm of command and control (C2).

Adversaries—both state and non-state actors—have taken advantage of the proliferation of available leading-edge technologies to improve their capabilities and challenge Marine Corps C2 systems. These proliferated technologies resulted in an electromagnetic spectrum that is increasingly saturated and contested, limiting C2 over traditional mediums. This situation includes an increasingly complex interplay of unmanned and autonomous systems that likely will not rely on traditional C2 methods, but will provide an exponential increase in data available to planners and decision makers. The speed and sheer volume of this data will easily surpass the ability of human cognition.

As all of these factors shape the new reality of the battlespace, it is unlikely that the Marine Corps will enjoy the same level of operational freedom—in all domains—that it has experienced in the past. Even today, the exponential increase in data has not led to a propor-

A portion of data collected can be transformed into useful information. *(Photo by Sgt Joselyn Jimenez.)*

tional increase in useable and actionable information for Marine Corps commanders and decision makers. Therefore, the Marine Corps must reimagine its methodology for C2. It must leverage and adopt new technologies and practices to make its raw data work for the planners, decision makers, and the warfighter. To the point, the future role of the Marine air C2 group should shift from a control organization to an information management organization.

Current State of Marine Air C2

The MACCS is predicated upon the doctrine of centralized command and decentralized control. The TACC provides the means for the MAW commander to communicate his intent to the MAW while coordinating with the joint air forces component commander. His intent is then passed through the TACC to the various Marine control agencies: direct air support center, tactical air operations center, air traffic control, and the low altitude air defense battalion. Each subordinate organization conducts its unique mission set to control and coordinate aircraft in support of the ground scheme of maneuver.

These agencies execute positive and procedural control through a robust collection of radio and radar capabilities that provide the ability to identify and communicate with aircraft. Furthermore, they typically operate out of fixed positions because of the size and logistic requirements for moving their equipment sets. During Operations IRAQI FREEDOM and ENDURING FREEDOM, the MACCS ensured unity of effort of aviation assets for geographically dispersed organizations across diverse terrain. Unity of effort and mission success were achieved by utilizing a robust communications structure that included data, single channel radio, and satellite communications nets.

Challenges to the C2 Status Quo

Reliance on the electromagnetic spectrum for MACCS mission effectiveness is a critical vulnerability that our adversaries are increasingly able to exploit. The vulnerability is highlighted by the large static spectrum signature that makes radar and single channel radio systems an attractive target. Additionally, the Marine Corps and DOD are investing in automated flight systems that will either be under remote control or operate autonomously. As these systems gain capabilities and become more prolific on future battlefields, there will likely be less requirement for traditional methods of control. However, the increased numbers of these systems and their associated sensors will exponentially increase the amount of data available to make an informed decision. This massive amount of information will need to be aggregated, synthesized, and understood by planners and decision makers at an accelerated operational pace. Data from additional cyber domains to include open source social media and the electromagnetic spectrum will add to the data load. These growing domains will have an impact on aviation scheduling, as more information will need to be considered when determining desired effects on target. The challenges associated with this massive influx of data is not something we will face "one day;" the challenge must be addressed *today* by restructuring the MACCS and growing the capability to leverage narrow band AI. The MACCS should shift from its traditional methodology and reframe the C2 problem for the future environment. By doing so, the organization will then be appropriately positioned to enhance the warfighting capability of the MAGTF.

The TACC provides the means for the MAW commander to communicate his intent to the MAW while coordinating with the joint air forces component commander.

Control Agencies Must Evolve Toward Information Management Agencies

As traditional necessity for controlling aircraft decrease and data availability continues to increase, the MACCS will need to consider how to properly quantify enormous amounts of data to present a useful picture for decision makers. When more data is aggregated by systems such as the Common Aviation Command and Control System (CAC2S), only a miniscule amount of the data collected is utilized in the decision-making process. Because of natural limitations in human cognitive capacity, a trove of potentially useful data is not used.

Currently, there is no clear means of aggregating the multiple streams of data. To deal with this, the MACCS needs to shift its focus from air control to information management so it can begin to transform these multiple data steams into actionable information in support of the MAGTF. Simply put, the question is: "How do we transform mountains of raw data into useful information?"

Quantifying enormous amounts of collected, unstructured data into useful information can be accomplished by utilizing narrow band AI. By allowing narrow band AI to identify patterns and suggest COAs based on evidence collected, the system could enhance the fidelity of decisions by providing an information-based suggestion. Ultimately, the decision cycle can be accelerated in both the planning and execution phase of operations.

AI tools are providing tangible results in a wide range of applications in the private sector, and these tools are available for implementation now. Some examples include the medical sector—where by aggregating multiple streams of patient data and cross referencing with medical journals and research, doctors could make more informed decisions when deciding a COA for patient care. Without these tools, doctors would be expected to digest thousands of pages of research and years of patient data in the hopes of identifying

Effective data analytics will provide the commander a complete pillar of the information environment. *(Photo by LCpl Ryanne Tschanz.)*

relevant patient care strategies. Another instance well documented is the use of AI in targeted advertising. Companies are able to aggregate data on customers from multiple sources to predict future behavior and ensure that the company is prepared to capitalize on likely opportunities. At the foundation of these success stories is the exploitation of data that was already available to the company, and their willingness to leverage new techniques in AI to integrate various data sources to produce meaningful information.

The *MAGTF Information Environment Concept of Employment* published in July 2016 advocated for the creation of a Marine information group. In the concept of employment, comparison is drawn to the organization and mission set of the Marine Air Control Group (MACG).[1] Based on the new reality of C2, it makes sense to transform the existing MACG into an information agency by increasing its capability to operate in the extensive information environment. Much in the same way that various agencies within the MACG are responsible for their portion of the control environment, various data streams can be processed and analyzed at subordinate agencies and fed up the chain to be aggregated and further analyzed. The ability to conduct data analytics at every level of the MACG and the expertise to interpret the data collected will provide the commander a complete picture of the information environment.

Companies are able to aggregate data on customers from multiple sources ...

It is About the Method, Not the Tool

While narrow band AI may seem like complete solution to exploit data already available to the Marine Corps, past experiments showed that integration of the human decision maker and the analytic system is more important than the actual tool.

Garry Kasperov highlighted this during his Centaur Chess experiment in 2008.[2] During the competition, amateurs using home-programmed laptops leveraged their method to beat super computers and chess grandmasters. Kasperov's experiment demonstrated something fundamental: the strength of the analytic system was not as important as the way the system was exploited by its human counterpart. Therefore, the ideal method of utilizing narrow band AI would likely be similar to its application in the famed chess match.

An organization experienced with applying a narrow band AI capability could consume copious amounts of various data streams and then propose suggested courses of action. In practice, the organization overseeing this analytical capability would take the proposed computer-generated courses of action, inject human creativity, factor in information external/unavailable to the system, and implement a robust option at a tempo to outpace our adversaries.

In the initial vignette of DAWN BLITZ, it is worth noting that no single data point led to these insights, instead—like the examples from private industry—the aggregate of multiple data points, the patterns recognized by the AI system, and finally the ability to use that knowledge to make an informed decision that leads to success.

In future conflicts, the technological advantage that the Marine Corps enjoyed during past conflicts is likely to diminish. The challenges faced by this closing gap mean we must take a hard look at past methods of C2 and identify areas ripe for innovative thinking. C2 is a crucial warfighting function that requires adaptation while embracing new capabilities in AI and data analytics to increase the capability, speed, and lethality of the MAGTF.

Notes

1. Headquarters Marine Corps, *Marine Air Ground Task Force Information Environment Operations Concept of Employment*, (Washington, DC: July 2017).

2. This information is available at https://jods.mitpress.mit.edu.