# Airborne Command and Control

## Making the case

by Capt Patrick Lauer

Aviation operations in the MAGTF are enabled by the command and control (C2) agencies that make up the Marine air command and control system (MACCS). These agencies provide

> the aviation combat element [ACE] commander with the air command and control support facilities and infrastructure necessary to command, coordinate, and control air operations within an assigned area of operations or airspace sector and to coordinate MAGTF air operations with other Services.[1]

Having spent three years overseas with Marine Air Control Squadron 4, Tactical Air Operations Center (TAOC), I have been exposed to the realistic capabilities and limitations with the MACCS for fulfilling this doctrinal mission.

For those who may be unfamiliar with the construct of the MACCS, it is made up of several specialized units that together fall under the colonel-level command of a Marine air control group (MACG). These MACCS units include the TAOC, the direct air support center (DASC), air traffic control (ATC), and the tactical air command center (TACC). For the purposes of this discussion, and to keep within my own immediate experience, I focus on TAOC operations. By doctrine, the TAOC is tasked to provide the following services:

- Detect, identify, and control the intercept of hostile aircraft and missiles and provide navigational assistance to friendly aircraft.
- Realtime surveillance of assigned airspace and direction, positive control, and navigational assistance for friendly aircraft.

***>Capt Lauer is the Officer in Charge, Air Defense Training Section, Charlie Company, Air Control Training Squadron, Marine Corps Communication and Electronics School, Twentynine Palms, CA.***

- Perform realtime direction and control of anti-air warfare operations involving aircraft and surface-to-air weapons.
- Collecting and displaying information from its own sensors, other Marine Corps sources, and external sources, the TAOC controls assigned airspace and directs and controls the fires of assigned air defense assets.[2]

A key attribute of the TAOC is that it provides positive control where aircraft are identified and tracked by electronic means such as radar.[3] As of fiscal year 2017, the TAOC still employs the AN/TPS-59 long-range three dimensional radar and the AN/TPS-63 medium-range two dimensional radar. Both of these systems are ground-based and their capabilities are driven as much by inherent system design as the physics governing the propagation of radio frequency radiation. Since the AN/TPS-59 is the primary radar deployed by the TAOC, I must focus on that system briefly to illustrate a few critical points.

The most relevant aspect of the AN/TPS-59 for this discussion is its coverage of airspace. As contained in the Lockheed Martin advertised specifications, the AN/TPS-59 has a maximum range of 400 nautical miles (nm) and a maximum elevation of one million feet.[4]

***The TAOC performs realtime direction and control of anti air warfare operation.*** *(Photo by Sgt Ronald Spotswood.)*

From personal experience, I can confirm that the elevation specifications are accurate, but the real variable, and the most relevant for a tactical C2 agency, is the detection range. At first blush, a 400nm detection range may seem fairly reasonable; however, consider the following hypothetical scenario—one that I was personally involved with planning for as a member of the TAOC.

The TAOC is deployed to an island after an opposed landing to help bolster aviation C2 capabilities within the MAGTF area of responsibility (AOR). For the sake of this discussion, the hypothetical adversary is a near-peer military power equipped with 4th generation fighters, like the Su-30 MKK (Flanker-G), and cruise missiles, such as the former Soviet Union Kh-55 (AS-15 Kent) which has a range in excess of 1,000nm. What must be remembered is that the curvature of the Earth creates blind spots below the radar horizon, or the lowest point of the AN/TPS-59s vertical coverage. To illustrate this phenomenon, take a spherical object, such as a tennis ball, and place a ruler or pencil against it. The ruler models as the radar horizon, the lowest point the radar can detect targets. Notice that as the ruler extends away from the ball, the greater the distance increases between the bottom of the ruler and the surface of the ball. The TAOC experiences a similar issue with the ground based AN/TPS-59; the further out a target is, such as an aircraft or cruise missile, the higher it must fly in order to be detected. A near-peer aggressor will know this and utilize tactics to exploit this to great effect. With only in this scenario, ground-based radar, there is a minimal likelihood of detecting aircraft or cruise missiles skimming the surface of the ocean before they are too close to negate their fires.

Knowing this, planners within the MACCS community, myself included, have tried to mitigate these hazards by employing airborne C2 platforms equipped with radar. Unfortunately, since the Marine Corps does not have this capability organically, the request is sent to our sister Services—specifically for the Navy's E-2 Hawkeye and the Air Force's E-3 Sentry. Apart from radar coverage, the TAOC is also hampered by the physical constraints of terrestrial-based radio antennas. While the TAOC may be able to see a great distance, our ability to communicate with pilots can be severely constrained, especially during bad weather. Here lies the crux of my argument; the TAOC is required by doctrine to provide the ACE commander with aviation C2, but in order to accomplish this without undue risk to MAGTF forces from hostile aircraft or missiles flying in a blind spot, joint support is required. The MAGTF is essentially forcing itself to involve joint forces in the execution of its mission.

***What must be remembered is that the curvature of the Earth creates blind spots below the radar horizon, or the lowest point of the AN/TPS-59s vertical coverage.***

From a doctrinal standpoint, at least from the paradigm of joint operations, this appears to be a *non sequitur*. Even in the Marine Corps' own warfighting publications, it clarifies that the MAGTF "serves as part of a joint task force under the command of a joint force commander."[5] With this understanding, then the utilization of joint assets to fill gaps in the MAGTF's own capabilities would be reasonable and even supported by joint doctrine. What this fails to account for is the realities of the situations when this is practiced in the real world.

From a pure numbers perspective, there are a finite number of airborne C2 assets available at any one time. Complicating this is the fact that as a high demand and low density asset, every commander within a given AOR wants and needs to employ them. This leads to a serious drawback in the reliance of joint airborne C2 assets, namely that the Marine Corps does not "own" these assets but they are instead "loaned" based on our willingness or ability to support MAGTF operations. The Navy E-2 Hawkeye is primarily focused on defending the carrier strike group, which must and should be its main mission. The Air Force E-3 has a slightly more flexible role but is typically owned by the joint force air component commander and has a much more expansive focus than MAGTF operations. While cross coordination between the E-2 and E-3 crews has been demonstrated to work for engaging threats that the land-based TAOC cannot see, there are some practical considerations that must be addressed.

The first and most obvious is that you now have two C2 agencies controlling the same airspace. Not only is this wasteful of a high demand and low density asset, but it sets the stage for conflicting orders being issued to pilots over the same radio frequency when one agency can see a threat the other cannot. In air combat, seconds matter. This self-generating confusion is not conducive to ensuring the survival of aircrews or ground units. Another practical consideration is that the MAGTF is essentially surrendering its ability to control the entirety of its airspace because of the lack of an organic Marine airborne C2 capability. This is particularly frustrating for the TAOC because we *want* to control the MAGTF airspace, and the current way of filling the TAOC capability gaps runs counter to Marine Corps doctrine of "*seamless air-ground integration* as force multipliers, known as maneuver warfare."[6] It takes time for E-3s to get into an AOR, and they require land-based airfields and substantial protection. E-2s, while ship-based, are tasked to protect the carrier strike group and, though that may include the MAGTF AOR, there is no guarantee that every time a MAGTF is deployed a carrier will be in support.

Having laid out reasons to reassess the use of joint airborne C2 assets to fill glaring gaps in MACCS capabilities to support the MAGTF, I offer a few

recommendations. Starting with what may be the easiest to understand, since it is a concept that has already received discussion, is an airborne early warning (AEW) MV-22 Osprey variant.[7] The Marine Corps has already vetted this platform's capabilities for amphibious operations, making it an ideal candidate for AEW conversion. This will give not only the MAGTF a dedicated Marine Corps airborne C2 capability, but one that can operate from expeditionary and austere environments which the E-3 and E-2 cannot. A pilot training program is already well established and the logistical needs of the basic MV-22 Osprey are already a part of the Marine Corps inventory. That said, there are two critical elements that must be addressed. The first is how these EV-22s are assigned. Would they belong to the MAGs as flying squadrons or to the MACGs as C2 squadrons? I recommend that they belong to the MAGs because of their existing ability to support airframes. Additionally, where would the controllers to operate the EV-22 radar and tactical data link systems originate? I suggest the TAOC community for the controllers and the MACCS community for the tactical data link operators since schoolhouses and periods of instruction are already in place.

Another option is radar equipped unmanned aerial systems (UAS) that are controlled by the TAOC. My first real experience with UAS was in Central Command involving the Battlefield Airborne Communication Node (BACN). The variant I worked with while serving as a watch officer in the joint interface control cell used a RQ-4 Global Hawk that was stripped of its imagery and other surveillance equipment and loaded with tactical data link systems and radios of various frequencies. With its long loiter time, high altitude, and ability to adjust position on demand, it was a phenomenal asset. There were days that my fellow technicians and I with in the joint interface control cell discussed at great length adding a radar capability to the BACN platform. The idea has stuck with me ever since.

During a recent exercise, the line of sight limitations of the AN/TPS-59 and radios continued to bedevil the TAOC and forced reliance on both the E-3 and E-2 in order to effectively counter simulated low flying cruise missiles and fighters. Since that frustrating experience of going to debriefs and having to field the complaints from our sister Services of the TAOC's inability to effectively control its assigned airspace because of our system capabilities, the idea of a radar equipped UAS took on new relevance in my mind.

What I envision is either a single platform, much like BACN, or a swarm of radar equipped UAS flying at extreme altitude (60,000 feet plus) and connected through a point-to-point high-speed tactical data link between each other and the TAOC. Not only will this negate many limitations the TAOC currently possesses, thus allowing the MAGTF to truly conduct aviation C2 organically, but it will also open up new avenues of using the TAOC. One example is sending out sections of the TAOC's "swarm" to provide intelligence, surveillance, and reconnaissance for ground units. Another is to allow the TAOC to engage in kinetic operations through the use of armed UAS, potentially serving as "missiles in reserve" for MAGTF fighters to call upon to assist in their mission. Granted, this will involve considerable investment in both material procurement and training, but even in its least advanced form, these aerial radar platforms will significantly increase the TAOC's capability to control MAGTF airspace and allow the MAGTF more self-reliance in the conduct of its scheme of maneuver.

***The MAGTF is a part of the joint force ...***

The MAGTF is a part of the joint force and can be expected to fight as such in accordance with joint doctrine. I do not argue with that tenet. What is a glaring deficiency within the MACCS community, but seems to receive scant attention outside the MACCS community, is the Marine Corps' overreliance on joint airborne C2 assets. The TAOC is expected, by doctrine, to provide the ACE commander C2 of his aviation assets. With the current equipment set, the TAOC can only provide a portion of those services. In combat with a near-peer adversary, and the already high demand for existing joint C2 assets like the Navy's E-2 and the Air Force's E-3, it is ill advised to place such reliance on external support. With anti-access/area denial a cornerstone in current tactical discussions, it is high time for the Marine Corps to assess gaining greater independence in the conduct of its mission rather than continued reliance on platforms that will be employed elsewhere or perhaps not even be able to join the fight. A critical component is an organic Marine Corps airborne C2 platform. We ignore this capability gap at our own peril.

**Notes**

1. Headquarters Marine Corps, *MCWP 3-25.3, Marine Air Command and Control System Handbook*, (Washington, DC: 1997).

2. Ibid.

3. Ibid.

4. Lockheed Martin, "AN/TPS-59 Long-Range Air Surveillance RADARs," Lockheed Martin, (Online: 2013), available at https://www.lockheedmartin.com.

5. Headquarters Marine Corps, *MCWP 3-20, Aviation Operations*, (Washington, DC: 2016).

6. Ibid., emphasis added.

7. Ben Ho Wan Beng, "Why the US Gator Navy Needs the EV-22," *The Diplomat*, (Online, June 2016), available at https://thediplomat.com/.