The Imperative to Integrate Air Force Command and Control Systems into Maritime Plans

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Those far distant, storm-beaten ships, upon which the Grand Army never looked, stood between it and the dominion of the world.

—Alfred Thayer Mahan

Command and control (C2) is an elusive Air Force core function. In the twenty-first century, globalized economies and worldwide threats make protection of the global commons more im-

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portant than ever. Future conflicts may be more challenging in the maritime domain than any since the Second World War. In a time when budgets force difficult force-composition decisions, risks in the maritime domain demand new forms of joint integration. Airpower remains the most responsive tool for many maritime tasks, but the Navy and Air Force require a new level of cooperation. Maritime commanders build maritime plans, but only Air Force systems possess the range, endurance, persistence, and capacity to provide sustained tactical C2 of the air-to-surface missions.

Risks to Supremacy in the Maritime Domain

Despite the evolution of airpower and the dawn of the information age, the sea remains vital to the diplomatic, economic, and military elements of power. Over the past 500 years, the world's great powers have depended on control of the seas for their hegemony.[1] Water covers 70 percent of the earth's surface and carries 90 percent of global commerce.[2] Locations like the Strait of Hormuz, Taiwan Strait, Senkaku Islands, and Black Sea are well known to the public for their strategic significance.

In this environment, modern near-peer or credible asymmetric threats may challenge US interests at great range and in ways that significantly disrupt freedom of action. In these antiaccess and area denial (A2/AD) scenarios, friendly forces will have to operate with many capabilities constrained or compromised.[3] Rapid technological growth has created a world defined by "proliferation gone wild," and our military supremacy will be contested rather than conceded.[4]

US and allied reductions in forces compound this threat. Even when capability and lethality are preserved, capacity and flexibility decline. Fiscal cuts can also erode technology, doctrine, and training advantages, allowing militaries and threat groups around the world to close the gap. Friendly forces distributed across numerous land bases allow more flexibility to address the expanded and shifting A2/AD fronts.

As threats grow and resources diminish, the services must increasingly lean on each other to attain operational objectives. Air Force and sea service cooperation is one area for improvement that has received significant commitment at the highest levels, translating into deliberate changes for many platforms.[5] Air Force fighters, bombers, and other aircraft now train to supply the Navy with additional muscle in war at sea. By doing so, the service addresses one limitation inherent to carrier basing but actually aggravates another risk—limited Navy capacity to provide the requisite C2 to orchestrate those additional numbers of joint air assets over wider areas for longer periods.[6] Coordinating and directing countersea airpower call for persistent, flexible, long-range, and high-capacity tactical C2 systems that can orchestrate the airborne elements of the surface fight on behalf of maritime commanders even when a carrier is absent, en route, or unable to respond. This need becomes apparent when one compares forecasted threats to present doctrine and fielded capabilities; further, it has been demonstrated by recent operational experience.

Air and Water Mix

Historically, most Air Force experience and doctrine have focused on cooperation with land forces, but airpower is an inherently cross-domain asset.[7] The air component exploits the air to generate effects and enable freedom of action in the land and maritime domains below. Indeed, the independent Air Force was born with a countersea legacy, stemming from Gen William "Billy" Mitchell's infamous tests culminating in the sinking of the battleship *Ostfriesland* in 1921. Because the US Navy has not been involved in a sustained conflict at sea since the Second World War, however, integration of the Air Force's countersea capabilities has languished for 70 years.

Navy and Air Force doctrine does not differ because of disagreement on universal truths about airpower but because a carrier air wing's first priority has to be defensive. The five carrier-on-carrier battles of the Second World War proved Mitchell right—it is possible to dominate the

sea from the air.[8] The Navy applied that lesson well by superseding the battleship with the carrier, building fleets around air strike, and re-christening carrier battle groups as carrier strike groups (CSG). At the same time, those experiences also taught that the source of the Navy's most flexible attack capability—the aircraft carrier—is a point target. Preservation of that force-projection capability throughout an operation demands protection of that base.[9] The resulting multiservice tactics currently emphasize the defensive, with a ship-centric bias that centers surveillance and engagement areas on the carrier rather than on an assigned area in which control of the sea is necessary (fig. 1).[10] Air Force doctrine, however, leverages larger, redundant, and distributed bases to enhance survivability and concentrate on the offensive nature of airpower.[11] Each force is right—or intends to be—for its service but has inherent strengths and vulnerabilities. Commanders should leverage both to carry out assigned missions.

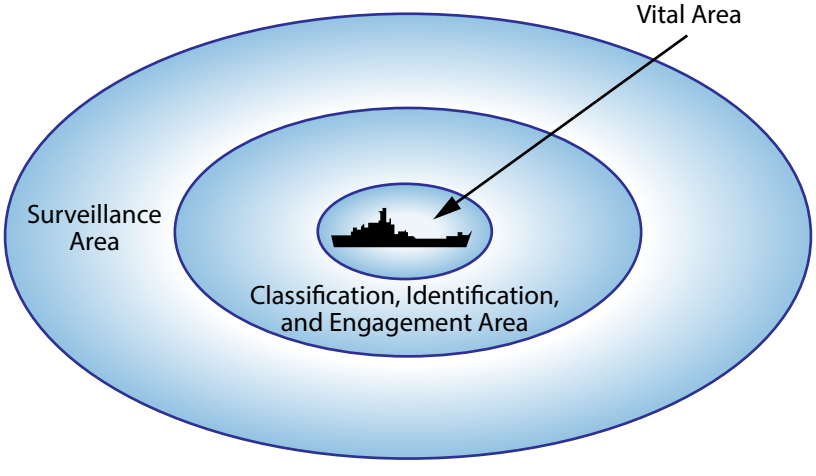


Figure 1. Surveillance area.(From Marine Corps Reference Publication [MCRP] 3-25J / Navy Tactics, Techniques, and Procedures [NTTP] 3-20.8 / Air Force Tactics, Techniques and Procedures [AFTTP] 3-2.74, *Multi-Service Tactics, Techniques, and Procedures for Air Operations in Maritime Surface Warfare*, 15 January 2014, 15, https://wwwmil.alsa.mil/library/mttps/pdf/aomsw_2014.pdf.)

Leveraging Joint Command and Control

Future maritime missions probably will demand joint air-to-surface force projection beyond the prioritized defensive layers around a CSG, in turn requiring coordination beyond the current capacity and capability of the sea services alone. No recent experience has challenged today's maritime force and tactics in this way, but contingency plans acknowledge that the intersection of threats and capabilities has changed. Direction of aircraft that support maritime commanders will likely be needed over broader and more dynamic geographic and tactical problems than ship-based C2 can manage. To project power and influence from the sea anywhere at any time demands the flexibility, speed, and range of airborne C2. The sea service's organic airborne C2 platforms, though, are far more limited in endurance, persistence, and capacity than those of the Air Force. Resolving such shortfalls materially would be fiscally prohibitive, but they can be and have been addressed well through the Navy's intellectual investment in sibling service platforms. This concept is not radical. The ongoing loan of Navy EA-6B Prowlers and EA-18G Growlers to the air component for expeditionary suppression of enemy air defense offers an excellent example of leveraging cross-service capabilities.

Though neither widely recognized nor explicitly directed, the maritime component's use of Air Force C2 to extend the maritime commanders' intent is already becoming common. The Air Force E-3 Airborne Warning and Control System (AWACS) has long been accepted as a supplement or extension to E-2 Hawkeyes for counterair missions. For countersea, the E-8C Joint Surveillance Target Attack Radar System (JSTARS) is emerging as an equally vital complement to Navy systems. Although designed to track tanks and trucks, that platform's radar inherently pursues anything moving, including boats and ships. Recognition of this capability has recently led to maritime missions in five combatant commands.[12]

Two recent experiences illustrate the efforts and imperative to integrate Air Force C2 systems into maritime C2 plans using the JSTARS.

In US Southern Command (SOUTHCOM), JSTARS crews have coordinated Coast Guard and allied sea and air operations in the absence of naval tactical C2. In US Central Command (CENTCOM), joint plans demonstrate a contingency in which JSTARS capabilities are critical to control of the sea.

Operational Example: US Southern Command

Illegal narcotics trafficking in the sea-lanes between South and North America is prolific. Joint Interagency Task Force–South (JIATF-S) is charged with the daunting task of interdicting those drugs. Budget constraints have significantly reduced the already limited participation of the United States and other allies. Both ships and aircraft have been scarce. Thus, recently, the JIATF-S had funds for just one heavy airborne asset and chose to fund the JSTARS to optimize limited resources by using its wide-area surveillance, robust communications, and C2 capabilities. That aircraft exceeded "detection and monitoring" expectations. Its range, speed, and endurance enabled tracking of possible smugglers transiting the vast SOUTHCOM area of responsibility (AOR); its flexibility allowed adaptation of the planned mission to developing intelligence and other factors—often several times in a single sortie.

JIATF-S is a complex organization that must coordinate the effort of 15 US agencies and departments and 14 partner nations, but mechanisms for the real-time direction of forces are limited. Without a tactical C2 intermediary, the full range of operational and tactical responsibilities is conducted by a small watch team on the joint operations center's floor, communicating directly with each asset. Centralized decision making far from the "front" and limited lateral coordination left substantial room for tactical C2 to grow.

After weeks spent building relationships, the JSTARS demonstrated the value of a capable and persistent C2 platform during a rigorous three-day hunt. The E-8C arrived on orbit shortly after dark to stalk

smugglers who used the cover of night for protection from visual detection. The platform's radar scanned the full length of the expected routes—more than 10,000 square miles of the AOR—in minutes. Using assessed profiles and cooperative identification methods, the crew detected numerous vessels and methodically sifted through known friendlies and legal traffic.

After hours on station, the surveillance team correlated an unknown surface contact to an off-board intelligence report for action. The internal fusion led the crew to a rapid decision to direct a US Customs and Border Protection P-3 Orion to investigate. The P-3 pursued the track and covertly obtained visual identification (VID) of a "go-fast"—a 35-foot commercial boat overpowered for smuggling (fig. 2). JIATF-S declared the track suspect as the P-3 ran out of fuel, validating the rapid, expedited decision making. Unfortunately, no ship was available to intercept. The JSTARS, with extended endurance from aerial refueling, maintained continuous tracking and thus preserved the identification (ID) in the event an interceptor was found. Over several hours, the suspect vessel followed a coast north and then evaded west among islands of a major inlet to hide from aircraft equipped with electro-optical/infrared sensors, often restricted to international airspace. The radar range of the JSTARS, however, easily covered the bay, enabling track continuity from an orbit over international waters. The crew assessed that its target was looking for a hide site and reported its last location to JIATF-S.

Figure 2. Helicopter-interdiction tactical squadron intercepting a go-fast boat during a training mission.(From "USCG Pursuing Gofast Boat," Wikimedia Commons, accessed 9 June 2014, http://commons.wikimedia.org/wiki/File:USCG_pursuing_gofast_boat.jpg.)

Two tense nights later, intelligence suggested the smugglers would resume their route, but this time partner nation patrols would be ready. The JSTARS would catch the departure and report their maneuvers so the interceptors could pounce as soon as the suspects crossed into their jurisdiction. As predicted, the crew did find a boat departing the last known location and reported it heading north. Unfortunately, the adversary also possessed a sophisticated network and warned the go-fast. Aware that interceptors were waiting, the target doubled back to another hide site, this time on the southwest side of a populated island. The JSTARS crew again passed its assessment and the latest position to

JIATF-S. In turn, Drug Enforcement Agency liaisons delivered the tip to local officials. What followed was an early morning law enforcement raid that confiscated 2,201 kilograms (2.2 metric tons) of packaged cocaine worth $235 million in the United States. Made possible by the range, endurance, persistence, and competence of the JSTARS crew, that one bust was one of the largest in the agency's history.

Command and Control Voids Filled by Command and Control Systems

The JSTARS arrived in SOUTHCOM as an additional surveillance asset but left as an integrated part of JIATF-S's C2 architecture. During formative early sorties, crews and planners perceived C2 voids and used the JSTARS to fill them within existing C2 plans to solve problems and expedite decisions. Over two months of operations, crews developed tactics including rapid orbit changes to orchestrate mass and maneuver at the critical point, prioritization of surveillance to orient air and surface assets, and expedition of partner nation execution using bilingual crew members. When it could and as it was able, the JSTARS bridged the operational-to-tactical gap and brought information dominance, decision superiority, and operational synergy to the counternarcotics fight.

This example illustrates what an airborne C2 platform can add to maritime missions when a robust, sea-based Navy C2 structure like a CSG is not present. Though it demonstrates the ability to expand influence and improve responsiveness, it does not demonstrate best integration into operational plans. Because of the brevity of the SOUTHCOM deployment, the JSTARS was included only in short-range planning, and C2 plans experienced no permanent changes. Law enforcement interdiction remained nonlethal, and the stakes did not directly include national survival or threats to the commons. Other maritime missions, however, stress the full range of military operations.

Operational Example: US Central Command

On the other side of the world, the JSTARS has an enduring presence and deeper cross-component integration. It has been a constant presence in CENTCOM, supporting operations in Iraq and Afghanistan since 2001. But in the second half of 2012, as the US withdrawal from Afghanistan took shape, readiness for other contingencies in the Middle East gained priority, and the JSTARS received new mission assignments.

The Arabian Gulf is a much narrower and more congested body than the Caribbean. Any future armed conflict in the Gulf has been likened to "a knife fight in a phone booth."[13] The Strait of Hormuz separates Iran and Oman by only 35 nautical miles, yet one-fifth of the world's oil is shipped through it.[14] The area is entwined in United Nations and US economic, diplomatic, security, and humanitarian interests. In the event of hostilities, the entire length of the Gulf would be a "front." Given the limited number of friendly warships in the Gulf, detecting and tracking the dynamic, low-signature small boats of the Iranian Revolutionary Guard Corps Navy can prove difficult. Further, its modern standoff threats and well-rehearsed asymmetric tactics pose significant indications and warning (I&W) issues. In 2011 US Naval Forces Central Command issued an urgent operational need to address the I&W problem by improving the inherent maritime surveillance capability of the JSTARS and maximizing its untapped capacity to extend the combined force maritime component commander's (CFMCC) influence across the battlespace. In 2012 crews arrived in-theater with a game-changing, improved maritime mode and trained on maritime C2 structures.[15]

In the Gulf, potential targets range from jet skis improvised as fast inshore attack craft to purpose-built fast attack craft and frigates (fig. 3). At first, JSTARS crews pushed every track they found beyond the range of friendly-ship organic sensors. Often reaching 80 tracks, this data proved too much, distracting individual ships with contacts beyond their task area and generating a prioritization problem to C2 and

intelligence entities. Over time, the JSTARS began to better understand the CFMCC's intent, fleet priorities, and I&W needs of each ship. Air Force C2 gradually became a better steward of maritime domain awareness and built confidence in the JSTARS as a maritime asset—the same confidence it has always enjoyed as an Army asset.

Figure 3. Example of modern Houbei-class fast attack craft. (From "Houbei [Type 022] Class Fast Attack Craft," Wikimedia Commons, accessed 11 June 2014, https://commons.wikimedia.org/wiki/File:Houbei_(Type_022)_Class_Fast_Attack_Craft.JPG.)

The JSTARS became a trusted I&W source while it controlled a maritime interdiction training mission with a flight of F-15E Strike Eagles. During the evolution, The E-8C detected numerous contacts departing an Iranian military port north of the exercise area. The surveillance team observed a complex formation of tens of contacts behaving atypically. First they set off across the Gulf, perpendicular to the usual flow of traffic. Then they executed synchronized maneuvers in concert with low, slow aircraft. The crew assessed that the formation could be only military and reported the activity. Later, overhead imagery confirmed the formation as an Iranian Revolutionary Guard Corps Navy fast at-

tack craft / fast inshore attack craft exercise. No platform other than the JSTARS reported the potential threat in real time.

Beyond I&W, JSTARS supplied many forms of control to maritime missions. Its planners made a case to the combined air operations center's intelligence, surveillance, and reconnaissance (ISR) planners to put surveillance assets under JSTARS control to amplify the surveillance picture. At the time, surveillance and reconnaissance platforms in the Gulf operated without tactical C2, using nothing other than their own electro-optical/infrared sensors to conduct maritime surveillance. Eventually the air tasking order assigned a single MQ-1 Predator to the JSTARS for an hour of overlapping station time and field of view.

The E-8C generated a surveillance picture, prioritized tracks for investigation, and directed the Predator to move rapidly from one location to the next. The JSTARS crew initiated tracks on all surface contacts in the Predator's operating area before it ever checked in, essentially performing the "find" step for the Predator. Rather than using computer-based tactical chat to direct the Predator, JSTARS controllers employed voice control, resulting in more rapid acknowledgement and execution of each task. Tactical chat was reserved for less timely and more detailed coordination. As soon as the Predator crew reported a VID, the C2 professionals aboard the JSTARS directed "skip it" and tasked the Predator to investigate the next-nearest contact while the E-8C maintained continuous tracking of the identified vessels. The combined C2/ISR team identified 13 contacts in just over an hour, five of which were Iranian military vessels. The reconnaissance asset moved from one contact to the next to rapidly build an ID layer on the surveillance picture rather than loiter on each target, as typically occurred in Operations Enduring Freedom and Iraqi Freedom, which demanded long sensor dwell to estimate collateral damage or assess hostile intent. After the mission, the Predator mission commander lauded the results—both the volume of tracks identified and the percentage that matched the tasking—declaring it the "best integration" of maritime surveillance yet.[16]

Building on those successes, JSTARS surveillance, intelligence fusion, and C2 became the tactical backbone of air operations in the Gulf whenever it was airborne and in the absence of a carrier. In the combined air operations center, planners ensured that the JSTARS always had control of at least one aircraft with ID capability—often a fighter conducting maritime interdiction training with the E-8C.

During one exercise, the JSTARS checked in with the sea combat commander (SCC) for a simple point-defense scenario. Two simulated opponent fast attack craft marshaled 60 miles west of a single destroyer, and the JSTARS controlled a flight of Strike Eagles to find, fix, and finish the adversary before it threatened the defended asset. JSTARS surveillance covered the friendly ship, the expected threat axis, the entire exercise area, and more. The controller directed two F-15Es to investigate two tracks in formation approaching the defended asset and promptly received VID of two patrol craft on a southeasterly course. The JSTARS mission crew commander passed the descriptions to the SCC, received a hostile declaration, and changed the Strike Eagle's task to target.[17] After a moment, the SCC received an update that both briefed threats were eliminated 60 miles from the friendly vessel. Skeptically, the exercise director reset the fighters, regenerated the opposing force, and resumed the scenario at 40 miles. The Air Force team repeated the rapid find, fix, and finish achievement two more times—at 40 and again at 20 miles. The debriefing verified the results and validated the JSTARS in maritime missions for US Naval Forces Central Command.

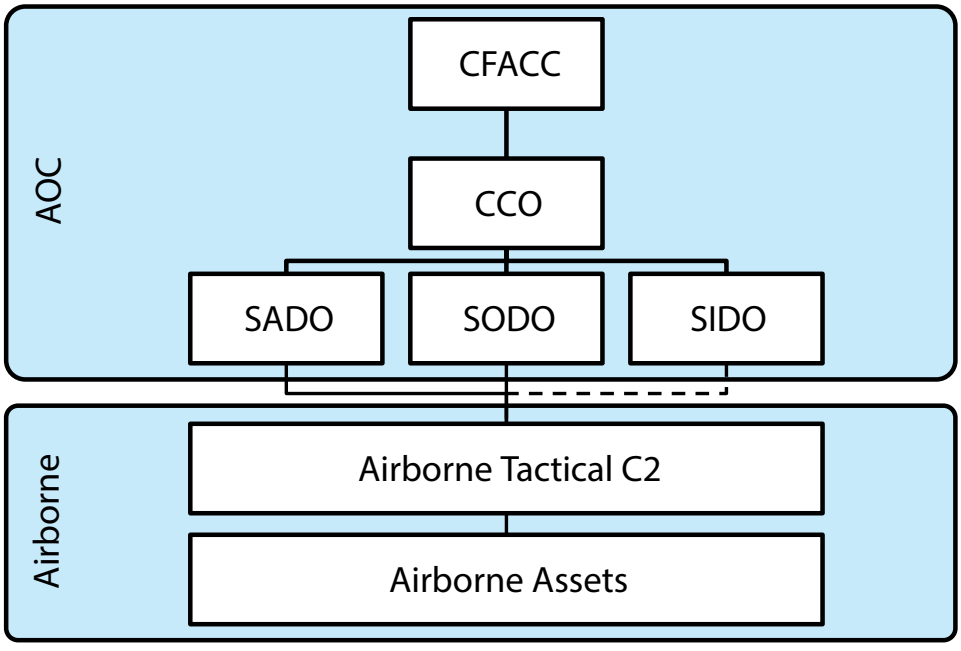
Supplementing a Ship-Centric Perspective

The seas are a vast stage where the curtain never drops; to be a star means meeting any cue any time. Seafaring nations exercise their economic and military elements of power over very large areas of influence. The CFMCC will be responsible for correspondingly large AORs, regardless of how well organic assets can cover it. With limited resources, the Navy must prioritize and position ships to defend and at-

tack at the most effective time and place while the enemy will naturally seek advantage elsewhere. The gap between enemy lines of advance and friendly-ship ranges is primarily the province of airpower, but carrier air wing C2 is limited in ways that land-based aviation is not. The constraints occur principally in quantity, range, payload, and persistence—especially during long-duration, high-tempo operations. In short, the CFMCC's ability to respond with the full range of military capabilities is constrained by the availability of ships, operational limitations of carrier-based aviation, and ship-centric doctrine. It is important to note that these limitations represent an even greater risk for the US Coast Guard, Marine Corps, and coalition navies who have little or no airborne C2 to begin with.

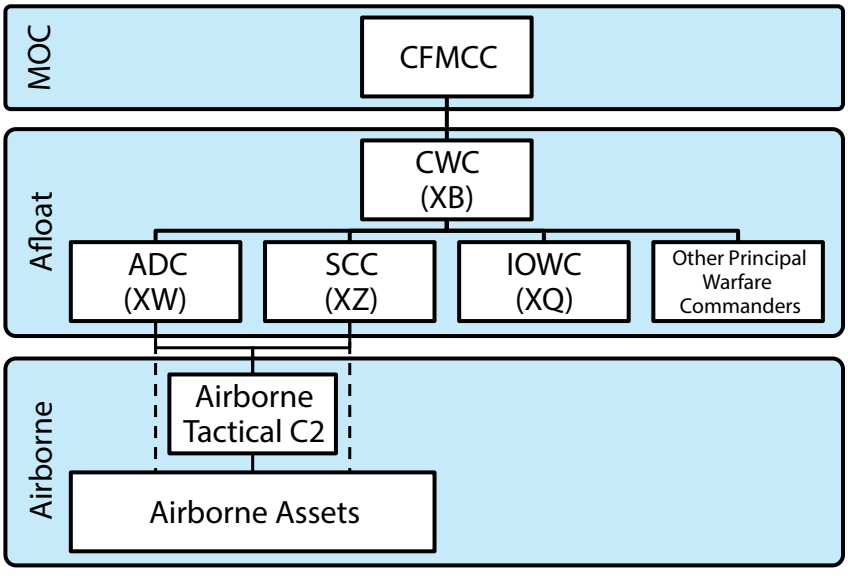
Doctrinal Differences

Adding Air Force C2 to existing maritime resources would expand and enhance the CFMCC's awareness and influence; doing so, however, requires the integration of two historically different command philosophies and C2 systems. The Air Force centralizes control in operational headquarters and in competent, capable, subordinate forward systems while necessarily allowing individual flights to execute their own tactics on time lines too short for higher echelons to manage.[18] The Navy, by tradition and necessity, typically commands through enduring but distributed nodes.[19] Each ship is an independent entity entrusted to carry out the commander's intent. The Air Force's theater air control system favors a clear break between operational and tactical C2 exercised by distinct platforms in the rear and forward areas (fig. 4). The Navy's composite warfare construct mixes operational and tactical responsibilities by function usually assigned to individual ships afloat with limited rear elements (fig. 5).[20]



Air Operations Center (AOC)
Combined Force Air Component Commander (CFACC)
Chief of Combat Operations (CCO)
Senior Air Defense Duty Officer (SADO)
Senior Offensive Duty Officer (SODO)
Senior Intelligence Duty Officer (SIDO)

Figure 4. Theater air control system. (Adapted from AFTTP 3-1.TACS, *Tactical Employment—Theater Air Control System*, 1 February 2013, chap. 1; and MCRP 3-25J/NTTP 3-20.8/AFTTP 3-2.74, *Multi-Service Tactics, Techniques, and Procedures for Air Operations in Maritime Surface Warfare*, 15 January 2014, 4–6, https://wwwmil.alsa.mil/library/mttps/pdf/aomsw_2014.pdf.)



Maritime Operations Center (MOC)
Combined Force Maritime Component Commander (CFMCC)
Composite Warfare Commander (CWC)
Air Defense Commander (ADC)
Sea Combat Commander (SCC)
Information Operations Warfare Commander (IOWC)

Figure 5. Composite warfare construct. (Adapted from AFTTP 3-1.TACS, *Tactical Employment—Theater Air Control System*, 1 February 2013, chap. 1; and MCRP 3-25J/NTTP 3-20.8/AFTTP 3-2.74, *Multi-Service Tactics, Techniques, and Procedures for Air Operations in Maritime Surface Warfare*, 15 January 2014, 4–6, https://wwwmil.alsa.mil/library/mttps/pdf/aomsw_2014.pdf.)

Command and Control Systems and Plans

There is no single C2 solution for all missions although most dedicated C2 systems, by design, are flexible enough to solve a variety of problems. C2 requirements should be defined and integrated during deliberate and contingency planning and periodically reevaluated at all levels as operations evolve. Consider a theoretical near-future conflict in the Pacific theater in which air superiority is required but counterland operations are secondary to sea control. The AOR in the Pacific Ocean, the largest body of water in the world, could range from Japan

to Australia and involve some of the biggest, most capable militaries in the world.[21] To maintain sea control in the face of widespread threats in a contested and degraded operations environment complicated by fog, friction, and chance, the maritime component must direct air operations beyond the CSG. Doing so, in turn, calls for unity of command and coordination of effort—in short, an appropriate C2 system integrated into tailored C2 plans (see table). So what does one need in a flexible C2 system to increase the range, capacity, and lethality of maritime commanders in the face of anticipated threats across the range of military operations? How would it be employed in cooperation with existing C2 plans?

Table. Components of C2 systems and plans

C2 Systems	*C2 Plans*
People	Intent
Competencies	Authorities
Platforms	Functions
Technologies	Tasks
Doctrine	Effects

C2 Systems

The requirements for such a system can be expressed in terms of its components: people, competencies, platforms, technologies, and doctrine. The people connect to the human elements of war and leverage their particular knowledge and skills that collectively form competence. They direct their prowess using the technology available from the vantage afforded by their platform. Finally, the system will craft ways of managing the battle and integrating to carry out the mission through doctrine. The most significant system risks that must be addressed are task capacity, a product of people and technology, and airframe endurance, a product of the platform.

People. Disseminating tactically relevant information and tactically sound decisions is the essence of C2, and it takes people to make assessments and issue judgments. Surveillance capacity must be suffi-

cient to detect, track, and report on all surface tracks across an assigned lane for air operations. Similarly, there must be sufficient weapons-control capacity to maintain accountability for and direct the movement and mission assignments of all aircraft conducting ISR and countersea operations, including manned and remotely piloted, rotary- and fixed-wing. Cruisers and destroyers have three controller positions, primarily for helicopter operations or control of a single fixed-wing division.[22] Hawkeyes have five crew members, typically performing CSG defense and therefore divided between air intercept control and maritime air control responsibilities. Though right-sized for individual ship operations or the scale of air operations that can be generated by the deck flow of a single carrier, they would become task saturated by the demands of large-scale, AOR-wide, cross-domain C2.[23]

Technologies. Technologies affect a C2 system in a variety of ways. The most externally relevant are sensors and communications. Anticipated A2/AD challenges demand a sensor capable of detecting and tracking as much of the maritime target set as possible at standoff ranges and a robust communications suite for contested and degraded operations. Radar, the prevalent airborne sensor for wide-area maritime surveillance, comes in many varieties. In a force-on-force scenario in blue water, the ability to track patrol craft and larger vessels is essential.[24] Modern air operations depend on a variety of voice and data methods, and interaction with the sea services levies additional requirements. Simultaneous and secure UHF, VHF, and satellite communications are essential to reach the full range of players reliably. To reduce workload through machine-to-machine interaction, one must have interoperable line-of-sight data links for working with US ships and aircraft; furthermore, those links are immensely beneficial for working with US and allied navies. Access to classified networks, especially for chat, has also become increasingly important.[25] Failure to participate in theater-wide tactical chat may slow the vital observe, orient, decide, act loop, whereas participation could close it.

Platforms. The perch for the C2 system, the platform defines how close to the fight the people in the C2 system will be and how far their influence can reach. The size of Pacific Command's AOR, the presence of regional and intercontinental threats, and the potential for around-the-clock operations drive demand for C2 systems with great range, mobility, endurance, persistence, and survivability. The ability to base from all over the AOR enables rapid response and opens up distributed basing options to ensure survivability of high-demand/low-density assets. For the theoretical scenario, highly enduring, capable, and survivable platforms might be needed to provide 24-hour operations in at least two locations at once—one to supplement where the CSG has primary responsibility and another in at least one additional place where the maritime commander needs to extend influence. The carrier-based Hawkeye significantly constrains the projection of maritime C2. E-2s are limited in speed, range, and endurance by turboprop engines and a lack of air-refueling capability, and in persistence by their crew and aircraft quantity as well as maintenance and deck turn times.[26]

C2 Plans

No matter how powerful or flexible a C2 system, failing to plan for it renders it less effective. If appropriate systems are not properly enabled by C2 plans, the unrealized or unfilled need for coordination may become significant enough for some unplanned asset affected by the problem to fill the need on its own initiative. Doing so can be unsafe, redundant, or—at the least—uncoordinated and poorly implemented. To ensure methodical, well-integrated, and tactically sound solutions, C2 plans must connect specific C2 systems to intent, authorities, functions, tasks, and effects to manage all applicable mission types. Existing operation plans and future deliberate and dynamic plans must be reviewed with this goal in mind. Consequently, maritime planners and commanders must be well educated about joint options, which could be addressed in formal courses for senior leaders and reinforced institutionally within the numbered fleets and CSGs.[27]

Intent. To control forces in the pursuit of the commander's objectives requires a clear understanding of his or her intent. The latter provides the operational momentum that keeps all subordinate forces traveling toward operational objectives even when commanders are not able to steer forces directly. For the Air Force, intent is usually received in the special instructions and the air operations directive. In the Navy, intent may be found in the operation order and daily intentions messages. When air operations support the maritime domain, two visions must be harmonized where they intersect to prevent friction. They must enable each other while honoring the fact that in the maritime fight, the CFMCC's intent is the authoritative one. C2 systems conducting maritime missions will be assigned to the CFMCC for tactical control. By extension, so will every asset that checks in with them. Over the past decade in Afghanistan, the Air Force has become quite comfortable taking control of Navy assets for close air support and suppression of enemy air defenses, but it is much less used to swapping roles and giving up control of its own assets to a supported commander. However, doing just that is essential to the unity of mission command.

Authorities. C2 systems are force multipliers even without the authority to make decisions and direct operations. To serve their purpose fully, however, they must be enabled to implement the commander's intent through clearly defined and specifically delegated authorities to decide, act, or direct. The most important authorities for controlling maritime interdiction are those required to prosecute and expedite the kill chain, including investigate and ID authority and possibly hostile declaration and target authority. Certain enabling authorities, such as engagement and rerole, probably will not be delegated to the tactical level but must be clearly assigned so that tactical coordination remains predictable and rapid.

Functions. Broad guidance of the kinds of things C2 platforms should do for superior commanders, subordinate forces, and all partners to influence the mission is the purview of functions. Air Force

doctrine defines six universal functions of tactical C2, which, when expanded, apply to any maritime mission: orient assets, pair effects, solve problems, speed decisions, bring order, and provide assessments.[28] Changing "orient and pair shooters" to encompass all mission players reflects the true breadth of C2, which affects all mission types, centralizing data from numerous manned and remotely piloted platforms, distributing it efficiently to air and surface assets alike, and pairing any effect to any target, whether kinetic, nonkinetic, or informational. This expanded definition is especially essential to maritime operations in which graduated responses and nonlethal operations such as boarding actions are common.

Tasks. Analyzing mission objectives in light of functions generates tactical tasks—specific actions that C2 must carry out. The list of functions is finite, but the complexities of the mission are legion when human error, the environment, and the enemy cast their vote. Tasks are therefore inherently dynamic and innumerable. Some can be planned for and articulated well in advance to guide preparation and execution of the C2 system. Others will become apparent only as they emerge and should be captured as lessons learned. Either way, they may emerge, fade, or change over time.

Air operations in maritime surface warfare (AOMSW) borrow some fundamental tasks from counterland tactics, such as reporting a VID to operational C2 and requesting permission to target. Even fundamental counterair tasks such as picture building are required to communicate fast inshore attack craft formations rapidly. Common tasks that the assigned C2 system must understand include safe deconfliction of airspace transit requests. Others are less apparent. We may need C2 to point out an adversary's remotely piloted aircraft to a frigate's bridge spotters or talk a fighter onto the wake of a passing suspect vessel. When explicit, tasks directly influence execution and must be managed effectively. Systems should not be assigned responsibility for tasks that lie outside their strengths. For example, the JSTARS should not receive counterair taskings just as the AWACS should not receive

countersea taskings. Any C2 system able to perform a task must, however, be prepared to do so in a contingency if it would accomplish any of the functions of C2.

Effects. Ultimately, C2 plans must enable C2 systems to generate mission effects. Like intelligence, C2 itself does not influence the enemy, but no coordinated military operation can succeed without it. C2 tasks ultimately get the right information to the right operator in the right place at the right time to generate the desired effect to further the commander's intent. In AOMSW this means that C2 should be focused on shaping operations to generate the intelligence, influence, or interdiction effects necessary to meet the maritime commander's intent.

Conclusion

The Hawkeye remains the premier tactical C2 system for countersea missions, but it is not singularly sufficient for the range of AOMSW challenges. To deal with numerous, determined, and competent foes, we need tactical C2 with higher task loads and coverage in more places and more often than carrier-based aviation can generate with the present or planned fleet. This tactical problem demands greater capacity, quantity, endurance, and persistence.

To mitigate these vulnerabilities, the maritime component must maintain unity of command in the maritime domain but incorporate joint C2 systems into training, doctrine, and C2 plans. Land-based Air Force C2 assets with larger crews can handle more substantial task loads and provide additional numbers; moreover, they are capable of greater durations and can sustain longer than carrier-based solutions. Sea services must train commanders and tacticians at all levels to take advantage of these capabilities and make their requirements for these joint resources known to influence systems from acquisition to operations. The comprehensive inclusion of these capabilities will significantly augment, amplify, and extend the effects of maritime forces to better address future missions, threats, and AORs.

The Air Force must enable supported maritime commanders by offering C2 systems and planning support. Other mission priorities should always be weighed and balanced. Nevertheless, during A2/AD phases of conflicts when surface threats and targets have a higher priority than land targets or when the latter are inaccessible even by standoff sensors, Airmen must consider whether the best use of the Air Force's tactical C2 may involve supporting the maritime component.

JSTARS crews have already demonstrated the value of integrating joint C2 in cross-domain missions in numerous operations and exercises around the world. Focused by a high-fidelity, wide-area surveillance suite building a comprehensive and accurate surface picture and an institutionally joint culture, the E-8C is ideally suited and already vetted to complement the sea services' own systems for AOMSW, surface surveillance, and other maritime missions. All services must work together to further develop a sense of cross-service investment in tactical C2 systems like the JSTARS, which perform so many vital functions to support commanders in the cross-domain battles of the future. ✪

Notes

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3. UK Ministry of Defence, *Future Character of Conflict* (London: UK Ministry of Defence, 2 February 2010), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/33685/FCOCReadactedFinalWeb.pdf. The document describes the battlespace of 2014 as "congested, cluttered, contested, connected and constrained" (15).

4. Briefing, Col Peter Ford, commander, 57th Adversary Tactics Group, Air Combat Command Weapons and Tactics Conference, subject: World Wide Threat Brief, 6 January 2014.

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envisions that "innovations are collaboratively developed and vetted to ensure they are complementary." Air-Sea Battle Office, *Air-Sea Battle: Service Collaboration to Address Anti-Access and Area Denial Challenges* (Washington, DC: Air-Sea Battle Office, May 2013), 9, http://www.defense.gov/pubs/ASB-ConceptImplementation-Summary-May-2013.pdf.

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9. Navy Tactics Techniques and Procedures (NTTP) 3-20.4.1.1, *Surface Warfare*, https://ndls.nwdc.navy.mil/BookViewer.aspx?docinstid=33.

10. "Defensive power is solely to gain tactical time for an effective attack." Hughes, *Fleet Tactics*, 144. See also Marine Corps Reference Publication (MCRP) 3-25J/NTTP 3-20.8/Air Force Tactics, Techniques and Procedures (AFTTP) 3-2.74, *Multi-Service Tactics, Techniques, and Procedures for Air Operations in Maritime Surface Warfare*, 15 January 2014, https://www.mil.alsa.mil/library/mttps/pdf/aomsw_2014.pdf.

11. "Airpower is primarily an offensive weapon." Col Phillip S. Meilinger, *10 Propositions Regarding Airpower* (Washington, DC: Air Force History and Museums Program, February 1995), 14, http://www.afhso.af.mil/shared/media/document/AFD-100525-026.pdf.

12. US Africa Command (AFRICOM), Operation Unified Protector; US Central Command (CENTCOM), maritime surveillance; US Southern Command (SOUTHCOM) and US Northern Command (NORTHCOM), counternarcotics; and US Pacific Command (PACOM), maritime surveillance.

13. Elisabeth Bumiller, Eric Schmitt, and Thom Shanker, "U.S. Sends Top Iranian Leader a Warning on Strait Threat," *New York Times*, 12 January 2012, http://www.nytimes.com/2012/01/13/world/middleeast/us-warns-top-iran-leader-not-to-shut-strait-of-hormuz.html.

14. Ibid. "The Strait of Hormuz is the world's most important oil chokepoint due to its daily oil flow of about 17 million bbl/d [barrels per day] in 2011, up from between 15.7–15.9 million bbl/d in 2009–2010. Flows through the Strait in 2011 were roughly 35 percent of all seaborne traded oil, or almost 20 percent of oil traded worldwide." US Energy Information Administration, *World Oil Transit Chokepoints*, full report (Washington, DC: Department of Energy, 22 August 2012), [3], http://www.eia.gov/countries/analysisbriefs/World_Oil_Transit_Chokepoints/wotc.pdf.

15. The enhanced land maritime mode provides clutter cancellation optimized for the surface environment.

16. Debriefing notes, 7th Expeditionary Airborne Command and Control Squadron, 10 October 2012.

17. Under composite warfare construct doctrine, the SCC call sign is "ZULU."

18. Curtis E. LeMay Center for Doctrine Development and Education, *Volume 1, Basic Doctrine*, 14 October 2011, 59–60, https://doctrine.af.mil/download.jsp?filename=Volume-1-Basic-Doctrine.pdf.

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20. Ibid.

21. Based on open-source reporting, the top five navies by number of ships include those of the Democratic People's Republic of Korea, China, United States, Iran, and Russia. The top three air forces by number of aircraft include those of the United States, Russia, and China. "Total Naval Ship Power by Country," Global Firepower, accessed 9 June 2014, http://www.globalfirepower.com/navy-ships.asp; and "Aircraft Strength by Country," Global Firepower, accessed 9 June 2014, http://www.globalfirepower.com/aircraft-total.asp.

22. A formation of four aircraft.

23. This situation has been acknowledged in some organizations as demonstrated by the Carrier Airborne Early Warning School's development of tactics, techniques, and procedures for employment of Hawkeyes in two aircraft sections to double controller capacity.

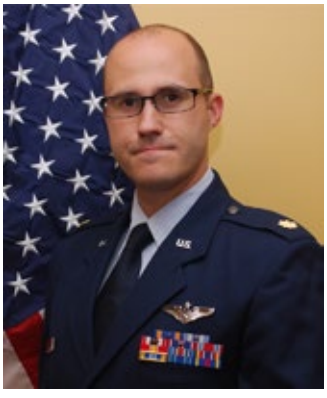
24. Patrol craft are among the smallest military vessel classes equipped with standoff weapons.

25. Tactical chat is used for "timely and accurate dissemination of commands" and for "information dissemination and cross flow coordination to increase situational awareness." AFTTP 3-2.77, *MTTP for Internet Tactical Chat in Support of Operations*, July 2009, 1–2.

26. A 2014 contract has been awarded to demonstrate E-2D Advanced Hawkeye in-flight refueling. Kirsti Dunn, "Northrop Grumman Awarded $226.7 Million for E-2D Advanced Hawkeye In-Flight Refueling," Northrop Grumman news release, 2 January 2014, http://www.northropgrumman.com/Capabilities/E2DAdvancedHawkeye/Documents/page Documents/E2D_In_Flight_Refueling_Release.pdf.

27. Venues for such training include the Naval Strike and Air Warfare Center's Carrier Airborne Early Warning Weapons School for Naval Flight Officers, Surface Warfare Officers School Command Department Head Course, and the Naval War College's Joint Force Maritime Commander Course for senior leaders.

28. Maj Gerrit H. Dalman, "Comprehensive C2 Core Functions and Authorities for C2 of ISR," bullet background paper, Air Combat Command Weapons and Tactics Conference, 9 January 2014, 2; and AFTTP 3-1.TACS, *Tactical Employment—Theater Air Control System*, 1 February 2013, A6-1.



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