Multi-domain Operations:  
A United States Air Force Perspective

The USAF has never faced a greater array of challenges in its 71-year history. Over the next decade, a perfect storm of technological change, emerging threats and newly assigned missions will demand nothing less than a culture change to meet them. Technologically, we have been in a revolution where machines are becoming exponentially faster and “smarter” in their ability to gather, store, access and process information. China, Russia, and other nations are challenging the USAF and air superiority can no longer be taken for granted. Space and cyberspace have been added as warfighting domains and the USAF will openly contest in them. Further complicating this situation, the USAF has had little recent experience with peer adversaries, having dominated in the air since the fall of the Soviet Union. The culture change to address these has been captured in our concepts of multi-domain operations and Multi-domain Command and Control (MDC2).

In recent years, our air operations centers have made significant advances to fuse space, air and cyber effects to support the joint fight. Because space and cyber were relatively benign environments for years, the overall approach viewed space and cyber as “supporting” capabilities designed to enhance “supported” operations in the air or other domains. Our approach has also focused on developing capabilities independently, and then seeking ways to integrate them at the point of execution. This approach leaves the vast potential of truly multi-domain operations untapped, and won’t allow the Air Force to compete, deter and win in tomorrow’s fight.

In fact, the multi-domain operations we will execute in the future is not the same as executing operations in multiple domains. The new concept includes operations in one domain enhancing operations in others, but more than that, it will include independent capability to create effects from air, space and cyber and it will include convergence of multiple domains’ effects to create wholly unique problems for the adversary to deal with. This creates hundreds of combinations of effects that an adversary will have to account for and defend against. Air Force Multi-domain Operations will include a vast array of options combined with our ability to C2 and deliver these effects at an operations tempo faster than an adversary can respond to. With this kind of force generating flexible, dynamic and complex dilemmas, our adversaries will constrain their behavior because they know that any aggression on their part will be met with an array of capabilities that they will not be able to counter… this is what 21st century deterrence looks like. In this mindset, Multi-domain operations are characterized by the following attributes:

- It is a combination of operations in and from multiple domains
- It is more than operations in one domain supporting operations in another domain
- It is capable of generating offensive and defensive effects independently in and from each domain
- It is designed to create and take advantage of windows of vulnerability
- It is capable of presenting multiple, simultaneous dilemmas for an adversary
- It is conducted at an ops tempo the adversary cannot match

Today, we are investing in the capabilities that will generate the multi-domain effects described above. We will have a mix of manned and unmanned aircraft, penetrating and standoff weapons, legacy and
next generation, on-orbit and terrestrial and kinetic and non-kinetic capabilities. We understand that our peer competitors will contest our dominance in the air, space and cyber domains and we will be ready to fight to maintain our freedom of maneuver in all of them. We will be able to protect our critical assets in these domains through a mix of resilience, redundancy and resistance. But adding the capabilities needed to control and exploit the domains of air, space and cyber is only one important aspect preparing for these kinds of operations.

For more than 25 years, the Air Force has been engaged in a particular kind of fight that has strengthened some of our “warfighting muscles” but let others atrophy. We have cut the size of our force substantially while increasing our mission sets and our operations tempo. All of which has resulted in significant second and third order effects on our readiness and lethality. So, as we take actions to build back the force we need, we must also address some of the more fundamental structural aspects of our Air Force. Specifically, we need to fix our fighting formations, strengthen our joint leaders and teams and build a multi-domain command and control capability.

**IMPROVING OUR FIGHTING FORMATIONS**

Squadrons are the fundamental building blocks of our combat capability and our Air Force culture. It’s where Airmen go from qualified to proficient to expert in performance of their duties. It’s where Airmen form their institutional identity and sense of belonging. And it’s where the innovation that is critical to maintaining our strategic advantage will happen. But this critical development and innovation will only happen if we offer our Airmen the time, tools and leadership to explore, fail, learn and thrive.

Revitalizing our squadrons is about improving our fighting formations. For all the reasons stated above, the Air Force cannot be successful without healthy squadrons. After looking extensively across the Air Force and characterizing the good and the bad, the conclusions are clear. A healthy, vital squadron has esprit de corps, purposeful leadership and is mission focused. Esprit de corps is a concept that captures all of the cultural aspects that lead Airmen to understand they are warfighters who belong to a valued team doing meaningful work. Leadership is perhaps the most critical element because it is so fundamental to setting the right tone and implementing the incentive structure that drives the right behavior. Purposeful leadership clearly communicates the squadron and its members’ purpose. Good leadership focuses on building and enhancing teamwork and creates an environment for calculated risk taking. Leadership should trust that Airmen will learn from their inevitable mistakes and sees this as a constructive part of the development process. Leadership also works hard to achieve work-life balances that are needed for resilience. Finally, healthy squadrons focus on the mission. They focus on effective outcomes, not just compliance, and they understand that readiness and lethality priorities will always outweigh other activities.

In order to fix our fighting formations and build the necessary leadership, mission focus and esprit de corps, we must give our airmen the time, the tools and the right leaders to make it happen. By reducing additional duties and ancillary training and streamlining AFIs, we are opening up time for airmen to explore, investigate and “talk shop” with mentors. These are activities that take Airmen from qualified and proficient to expert and mastery levels. At that knowledge level, Airmen will understand how their work fits into others’ work. They will begin to understand the broader mission sets of our Air Force and only then will the conditions are set for real innovation. They will begin to apply their knowledge and energy towards new TTPs and combinations of activities that will be needed in future fights and our readiness and lethality will grow exponentially.

But this creative energy that sparks innovation will have to be nurtured…we must stoke those fires with additional resources and leadership. The resources can occur in many varieties from simple debriefing tools to complex exercise venues. We are working hard to improve our operational training infrastructure to support development of innovative warfighting concepts and we are providing funding for innovation at the wing-level to underwrite the best ideas. Furthermore, we are investing in leadership with new training and education starting earlier in careers so that young leaders can explore methods to
motivate and inspire and find what works best for them and their organizations. We are also bolstering our leadership by pushing authorities down to the appropriate levels to match the responsibilities we have given our leaders. With the time, the tools and the leadership to excel and innovate we can build a culture of readiness and lethality for the multi-domain operations that will be needed to address the challenges our joint force will face in future conflict. Which also means Air Force squadrons must be able to seamlessly and rapidly integrate into a joint warfighting team.

**STRENGTHENING JOINT LEADERS AND TEAMS**

Future conflicts, especially those with peer competitors, are likely to unfold very rapidly. Air Force capabilities and the Airmen that turn those capabilities into combat power must be able to integrate effectively into joint warfighting teams at a moment’s notice. Because long lead time for spin-up is unlikely, Airmen must be ready to effectively contribute to the joint fight on day one. Therefore, it is imperative that we invest now to strengthen our joint leaders and teams so they will be ready to integrate into, influence and lead joint warfighting teams.

In order for us to operate effectively as a part of a joint warfighting team, our Airmen must have joint credibility. This joint credibility comes from the appropriate level of joint training, joint education and joint experiences needed for the joint role Airmen are asked to play. As our Air Force participates in joint training events, we learn the nuances, challenges and opportunities that come with being part of and integrating into a joint force…and we gain joint credibility. By educating ourselves on joint doctrine, joint processes and joint organizations, we develop the necessary joint vocabulary and understanding to influence joint operations and ensure airpower is seamlessly integrated into joint warfighting…and we gain joint credibility. Most importantly, as Airmen gain first-hand experience by serving in joint positions of increasing responsibility in the course of their careers…they gain joint credibility. Once established, this joint credibility will strengthen our ability to integrate into, influence and lead joint operations.

But getting the right training, education and experiences for our Airmen will not happen serendipitously. Establishing this kind of joint credibility will require us to deliberately force develop our Airmen and incentivize the pursuit of joint understanding. As an Air Force, we must balance the value we place on deep understanding of Air Force capability with the need to understand the broader joint environment and invest in time needed for our Airmen to develop joint credibility. This is a multi-faceted effort that requires us to enhance our continuum of learning by accounting for joint training, education and experiences and then carving out the time for our Airmen acquire this knowledge and skills. Finally, we must value and reward Airmen who establish joint credibility and build a system that incentivizes pursuit of joint knowledge and experience. Airpower will be executed by our nation in joint forces. We must deliberately prepare our Airmen for this environment by strengthening our joint leaders and teams. In addition to being a joint environment, future conflicts will also be multi-domain which requires us to have a C2 system that allows us to seamlessly and dynamically shift between regions, component and domains to integrate effects. That C2 system is addressed by our Multi-domain Command and Control initiative.

**DEVELOPING MULTI-DOMAIN COMMAND AND CONTROL**

There is an example from early in U.S. history that illustrates the effect multi-domain operations can have on an adversary. In 1775, British troops were garrisoned in Boston and being harassed by the colonists. After many incidents, the British garrison decided to take decisive action and march out of Boston to the town of Concord and seize a store of weapons the colonists had stockpiled there. The colonists became aware of the British activity and wanted to warn the colonists in Concord so they might take defensive actions. The operational problem for the defense of Concord was that there were two avenues of approach from Boston to Concord and because they had very limited defensive capabilities, the colonists would need to mass along the correct avenue of approach.
Therefore, the famous signaling event we are all familiar with was devised...one if by land, two if by sea. Meaning, one lantern would be hung in the Old North Church tower if the British were marching south out of Boston across the land bridge before turning west and north to Concord. Two lanterns would be hung if the British were rowing across the Charles River before marching on a more direct western route to Concord. The British decided to row across the Charles River, so two lanterns appeared that night in the Old North Church. So what does this have to do with multi-domain ops?

Because the British had the ability to attack along two different vectors, the colonists had to have two different plans...one to engage an attack coming from the south and one from the east. Complicating an adversary’s planning increases the likelihood of weaknesses in the plan. If a force increases the number of possible attack vectors, it creates dilemmas for the adversary. Imagine if the colonists had to plan for more than two lanterns...one if by land, two if by sea, three for air, four for space and so on...

But don’t stop there, looking back on the colonists’ plan: what if the British had split their force and approached simultaneously by land and sea? The colonists would have been placed in an even tougher dilemma. Do they pick one approach to defend and concede the other approach or do they divide their small force into smaller ones and risk failing to defend either approach. But the British did not have the ability to C2 a split force and synchronize the efforts so it was not a viable option that the colonists needed to worry about. Our multi-domain operations effort will not only increase our ability to attack and defend from multiple vectors, but we will enhance our C2 capabilities to be able to seamlessly and dynamically shift between domains, regions and components to ensure we have viable means for creating dilemmas from multiple vectors. To ensure our joint force has the ability to command and control forces across multiple domains, regions and components, the Air Force is exploring enhanced operational concepts for C2, advanced technology and deliberately developing operational-level C2 expertise.

**MDC2 Operational Concepts**

Because multi-domain operations will leverage capabilities across multiple commands, regions and components, we must explore operational C2 concepts to enhance support and supporting command relationships for multi-domain ops. We must design and practice with flexible C2 structures that can be employed in various combinations and locations and still maintain operational agility and decision speed. We must also mature processes and procedures for contesting the space and cyber domains in order to integrate them into the processes we have developed for contesting the air domain.

Consider a future mission to suppress enemy air defenses. The Air Force will be able to generate kinetic and non-kinetic effects directly from platforms in air, space and cyberspace. These effects will be integrated and synchronized such that their combination is greater than the sum of their parts. The adversary will be forced to make decisions: “Should I turn on my acquisition radar and risk a kinetic strike from an asset outside my protective bubble?” or “Can I trust the targeting information that my computer or regional controller is giving me?” or “If I isolate my system to protect against cyber attack, how do I build SA?” The dilemma for the adversary is simply, attempt to use the air defense systems and you will lose them...decide not to use the air defense systems and you are not able to protect yourself from an attack.

True multi-domain operations present coordinated challenges across time and space that are domain agnostic – converging and disrupting in multiple domains simultaneously – creating windows of superiority that can be exploited to penetrate, persist, protect or punish to achieve desired effects. This creates an especially difficult challenge for our competitors, as their A2/AD systems are designed to deny access to individual domains. Multi-domain operations impose great cost upon our competitors by forcing them to defend all domains, all the time.

But in order to effectively generate and synchronize the multi-domain capability it will require us to answer many C2 questions. For example, where and how is the multi-domain plan designed? Who has execution authority and how is it accomplished in each domain? How do we integrate multiple commanders’ planning, targeting and tasking cycles across multiple combatant commands? How do we
conduct multi-domain battle management? How do we train multi-domain force package commanders? These are complicated C2 questions for which there is no single right answer. The circumstances will dictate the best structure. But to ensure we have the flexibility and agility to employ the right C2 structures we have to explore and experiment with the various concepts in detail.

In November, we will execute the inaugural Doolittle Wargame to explore enhanced and flexible C2 structures. The overall purpose of the Doolittle Wargame is to modernize and optimize rules, responsibilities, relationships, and authorities (R3A), tactics, techniques, and procedures (TTP) in order to execute the commander’s intent in a contested environment. These efforts will enhance our ability to employ integrated effects across the Air, Space, and Cyber domains at an operational tempo no adversary can match. The product of the wargame will include a series of recommendations and proposals to enhance all aspects of operational C2 from ROE, integrated planning concepts, battle management mechanisms and conditions-based delegation of authorities. These concepts will then be incorporated into our exercises and training venues for further development, refinement and implementation.

“**We are transitioning from wars of attrition to wars of cognition…now we are starting the dialogue with…Does it connect? and Does it share?**

- General David Goldfein

**Advanced Technology**

Command and control is essentially three functions: gaining and maintaining situational awareness, making operational decisions and directing forces. The Air Force has tremendous capacity to collect data to inform situational awareness. However, that massive amount of data and the additional information that is available now through global exchanges like social media, must be rapidly assimilated and contextualized in order to effectively support decision-making. Furthermore, the number of decisions that need to be made in support of integrated and synchronized multi-domain operations is staggering, not to mention dispersed across the globe in various commands. Finally, directing globally arrayed forces from CONUS-based airlift, to satellites in space, to JTACS at the forward edge of combat will be challenging in contested environments. But to effectively accomplish multi-domain operations we must be able to continuously and effectively perform these functions. Therefore, the Air Force will pursue advanced technologies and transform into a Digital Air Force in order to enable multi-domain operations and its prerequisite C2 functions.

In its simplest form, a fully Digital Air Force is one in which rapid multi-faceted sensing, identifying, attributing, and sharing of large volumes of information, and the global network of inter-connected systems that makes data discoverable and available across all levels of the enterprise, anywhere in the world, in real-time…is the standard.

“**…we will link sensors on multiple platforms—from sea, ground, air, space—to gather, analyze, share, and act on information faster than our adversaries, so that we prevail and win.”**

- 2018 National Defense Strategy

In the future Air Force, quantum computing, rapidly upgradable software, discoverable data, and interoperable and self-healing systems will be an inherent part of every platform, system and network. Machine learning, human-machine teaming, artificial intelligence, autonomous operations and big data analytics will be built into operating systems and C2 nodes. By taking advantage of these advances in technology, the Air Force will be able to observe and orient faster which will lead to higher quality decisions made at a faster ops tempo and allow us to get the right information to the right forces at an operationally relevant speed. The exponential increase of information pathways will make it possible
for kill chains to be truly domain-agnostic, with sensing, decision-making and the delivery of effects occurring in, from, or through any domain—or in multiple domains—at any time with blinding speed. Digital speed and information superiority, not industrial capacity, will win the next war.

“The future force … must be adaptable to account for uncertainty … and depends on the ability to integrate new technologies, adapt warfighter approaches, and change.”
- 2018 National Defense Strategy

But there is no single technology or set of technologies that will deliver multi-domain operations. It will require a continuous process of development, innovation and rapid integration of the newest capabilities. Because of this, we will need to focus initially on setting the conditions that lead to rapid integration of technology. Our initial efforts will focus on six categories of enterprise-wide challenges: security of our data and networks, broad access to all of our data, data latency, bandwidth, network management and resiliency and managing a published set of information technology standards.

The Air Force has documented its Data Strategy and we must be disciplined as we implement it across our enterprise and as we acquire new systems and data sets. We are also establishing a Shadow Network (ShadowNet) to experiment with solutions to the enterprise-wide infrastructure challenges. The mission of the ShadowNet is to employ advanced technology to inform future MDC2 concepts and capabilities and the attendant data enterprise, network, technical & acquisition policy, industry collaboration and Joint/coalition interoperability solutions.

The initial objectives of the ShadowNet experimentation are:

1. Mature the Air Force’s understanding and use of data virtualized in cloud structures;
2. Create a scalable operational infrastructure and data architecture;
3. Explore artificial intelligence, machine learning, human-machine teaming & automation in support of enhancing C2 processes and critical functions;
4. Experiment with and explore innovative C2 technologies for multi-domain ops;
5. Experiment with, develop and integrate advanced multi-level security tools and capabilities to enhance C2 interoperability and data sharing; and,
6. Experiment and innovate new approaches to software testing and “authority to operate” processes in order to accelerate delivery of C2 capabilities to the field.

**Developing Multi-domain Expertise**

Multi-domain operations and its C2 will be more complex and require faster execution against a peer competitor. The emergence of space and cyber as contested domains, threats becoming increasingly trans-regional and global, and the necessity of compressing the Observe-Orient-Decide-Act (OODA) loop will stress our personnel, structures and processes. As we develop our Airmen for multi-domain operations, we must recognize that we are shifting from a value proposition that keeps a premium on tactical depth and expertise, yet also adds important operational and multi-domain breadth. This will require an Air Force continuum of learning that includes multi-domain operations and C2 experts in order to deliberately develop the force we need. Finally, operational-level C2 is the only Air Force core mission mostly done as a “pick-up” game. We must ensure that Airmen assigned the critical responsibilities of multi-domain command and control have the training, education and experience to perform in this complex environment.
To execute effective operational-level C2, the Air Force will need purpose-built experts with appropriate levels of training, education and experience to execute new C2 processes, procedures and tools and perform effective multi-domain planning and synchronization. To address this challenge, the Air Force will establish a mid-career cross-over Air Force Specialty Code (13O) to formally designate, train, educate and experience our operational-level C2 operators.

“*The current bureaucratic approach, centered on exacting thoroughness and minimizing risk above all else, is increasingly unresponsive. We must transition to a culture of performance where results and accountability matter.*”

- 2018 National Defense Strategy

In conclusion, the security environment that we find ourselves in and the nature of threats that we are likely to face in the future will require us to be able to generate a wide variety of warfighting options. It will also require a robust level of resilience as we will be forced to conduct all of our operations in contested domains. Finally, it will require us to operate at a high velocity operations tempo. We will have to observe, orient, decide and act faster than our adversary. The side that succeeds here will have the strategic advantage. In short, this means we will conduct multi-domain operations…seamlessly shifting between domains, components and regions to create high velocity, operationally-agile, precision warfighting effects to satisfy a Joint Force Commander’s mission needs. In order to conduct multi-domain operations effectively, the Air Force needs high functioning squadrons as our fundamental fighting formation. We need strong joint credibility to integrate into, influence and lead joint warfighting teams. And we need the ability to command and control air, space and cyber power dynamically in integrated combinations that create dilemmas that an adversary cannot match.

In order to win our Nation’s wars, we must shed our misconceptions and “old thinking” on single-domain-specific warfighting concepts. We must embrace and integrate technology much faster than the enemy, even if that means getting more comfortable with failure and managing risk. Finally, we need to train, educate and experience our Airmen to rapidly integrate into and lead the joint, multi-domain team. This is a process, not a product. We must understand that we will be perpetually enhancing our ability to conduct Multi-domain operations as the adversary will continuously be working to counter our efforts. This is what is required to conduct multi-domain operations, what it means to deter in the 21st century and what it will take to maintain our strategic advantages and win if necessary in this era of great power competition.