Viewpoint

TWENTY-FIRST CENTURY AIR POWER: FUTURE CHALLENGES AND OPPORTUNITIES

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INTRODUCTION

Change with respect to the military in general, and air power[1] in particular, involves four principal factors—advanced technologies, new concepts of operation, organizational transformation, and the human dimension. Here is how they all relate in forming the future: *advanced technologies* and the new capabilities they yield, enable and demand *new concepts of operation* that produce order-of-magnitude increases in our ability to achieve desired military effects. *Organizational* transformation codifies changes and enhances our ability to execute our respective national security strategies. The final and essential element to progress is the *human dimension*. People are fundamental to everything air forces do, especially when it comes to planning for and executing combat operations. Accordingly, I've outlined this paper generally in these four broad areas. However, before addressing them let me provide a short assessment of the security environment we face in the remainder of the twenty-first century.

TWENTY-FIRST CENTURY SECURITY ENVIRONMENT

First, in this the twenty-first century, our defence strategies must contend with non-state and transnational actors; a rising economic and military powerhouse in China; a resurgent Russia; declining states—some with nuclear weapons; the increasing likelihood of nuclear weapons proliferation; evil actors of the most despicable nature; and a dynamic web of global terrorism.

Second, the pace and tenor of our lives has been irrevocably altered by the acceleration of change. Global trade, travel, and telecommunications have produced major shifts in the way we live. Such developments are not isolated. Speed and complexity have merged, and now *permeate* the conduct of warfare. Consequently, one implication for future warfare is that military forces *must* be able to respond rapidly and decisively anywhere on the globe at any time. Key security events can now unfold in a matter of hours and days, not only over months or years. The window to influence such circumstances is increasingly fleeting, and rapid response—lethal and/or non-kinetic—anywhere in the world is a primary characteristic of air power. This cannot be said of land or sea forces, both of which are subject to the tyranny of time and distance.

Third, we have to contend with increasing personnel and procurement costs at a time when defence budgets are decreasing. Therefore, *the provision of flexibility of response across a wide spectrum of circumstances* should be foremost among the decision criteria we apply to our future military. This too is an air power strength.

Fourth, moving into the future we must acknowledge that deploying large numbers of ground forces onto foreign soil to 'win hearts and minds' vice accomplishing a defined mission and then leaving has become counter-productive to securing desired strategic outcomes. That approach resulted in decades-long wars that slowly but inexorably drained our blood and treasure while undermining our political will and standing in the

world. Strategies centred upon occupation expose coalition force vulnerabilities, result in anti-occupation force national backlash, domestic disapproval, and create destabilizing effects within the very state or region they are intended to secure.

Fifth, we must actively pursue and invest in options we can use to counter the increasingly advanced access denial strategies and technologies our adversaries are developing. Precision weapons and stealth projected incredible effects at the end of the Cold War. Those capabilities proliferated, and our adversaries are now equipping themselves with precision weapons and stealth.

Sixth, and particularly important, we need to challenge our adversaries' domination of public perception. We have to learn how to use the application of accurate, compelling information as a core element of our security apparatus. We are woefully inept at strategic communications and too often put ourselves in a reactionary versus proactive position in struggling to gain domestic and international public support.

Finally, information's value also extends past the media. Just as wireless connectivity, personal computing devices, and cloud-based applications are revolutionizing life in the civilian sector, these trends are also altering how our military forces project power. Faster and more capable networks and computing capabilities are turning information into the dominant factor in modern warfare. We need to understand that fifth generation aircraft like the F-22 and F-35 are information systems far above and beyond being fighters that shoot missiles and drop bombs—they are sensor-shooter-effectors.[2] Given this reality, we must now acknowledge that information and its management are just as important today as the traditional tools of military power—airplanes, satellites, infantry, warships. Information is the force evolving all weapon systems from isolated instruments of power into a highly integrated enterprise where the exchange of information and data will determine military success or failure in the twenty-first century.

The factors identified in this short assessment of the security environment we face have major implications throughout the military enterprise, shaping key areas like doctrine, organization, training, acquisition, sustainment, along with command and control. Top leaders in the policy community must adjust to the new realities of information age combat operations. Cold War, occupation-based, and counterinsurgency paradigms fall woefully short when applying military power in the twenty-first century.

These trends provide a starting point for anticipating the future with which we will have to contend. Bluntly stated, all the services, ministries of defence, and the other elements of our collective national security architectures have been slow to recognize the emerging new security environment. Their focus has remained on traditional weapons platforms. We still have institutions and processes that were designed in the middle of the last century to accommodate what we now view—in retrospect—as a

rather simple world of kinetics and traditional domains that characterized the Cold War. I suggest that we need to supplement our traditional focus on combined arms warfare with a broader 'lens' that exploits non-kinetic tools, the cyber domain, the rapid translation of information into knowledge, and air power as a means of rapidly imposing these capabilities into desired effects.

The proliferation of technology, information flow, and the associated empowerment of nation-states, organizations, as well as individuals, presents one of the most daunting challenges our militaries have ever faced. How will air power fare in this rapidly evolving security environment of the future?

FUTURE TECHNOLOGICAL POTENTIAL APPLIED TO AIR POWER

Today we can identify progression in some technological developments that hold great potential for the advancement of air power in the future. Here are the ones that I believe will result in significant new air power capabilities that will shape its future:

Uninhabited aerial vehicles

The acceleration of the use of remotely piloted aircraft (RPA) — or better known by their flawed media label as 'drones.' RPA will quickly transition to a much more autonomous ability to assist airmen in the accomplishment of their mission tasks across the spectrum of air power operations. The future will see remotely piloted aircraft increasingly replaced by aircraft flying autonomously. At the same time a human will be 'on the loop' controlling the effects of these autonomous aircraft. The term RPA was introduced in 2009 to ensure it was understood that humans were in control of uninhabited aerial vehicles. I suggest that we consider a descriptor along the lines of *Coordinated Autonomously Piloted Aircraft*, or CAPA, to distinguish the use of aircraft flying autonomously vice those actually remotely piloted.

Fast space

This concept explores whether and how air forces can form private sector partnerships to create a virtuous cycle of launch cost reductions of between three and ten times lower than today's costs. Doing so could enable completely new approaches for Allied air forces to defend our coalitions, protect our interests, and enhance opportunities to exploit the unique global advantages of the ultimate high ground of space.

A 'Fast Space' architecture envisions an ecosystem of capabilities that makes *speed* the defining attribute of advantage in space. In this approach, speed describes both the supply and demand sides of the space market. On the supply side, Fast Space envisions sortie-on-demand launch capability, made possible through economically viable business cases, high launch rates, sustainably lower costs, rapid turn-around, and higher reliability. On the demand side, Fast Space enables users at all levels of conflict, from tactical to strategic, to harvest new advantages in and through space.

Hypersonics

Flight at five times the speed of sound and above promises to revolutionize military affairs in the same fashion that the combination of stealth and precision did a generation ago. Hypersonic air weapons offer advantage in four broad areas. They counter the tyranny of distance and increasingly sophisticated defences; they compress the shooter-to-target window, and open new engagement opportunities; they rise to the challenge of addressing numerous types of targets; and they enhance future joint and combined operations. Within each of these themes are other advantages which, taken together, redefine air power projection in the face of an increasingly unstable and dangerous world.

Artificial intelligence (AI)

Many years ago, as the Chief of US Air Force Intelligence, Surveillance, and Reconnaissance, I coined a phrase to try to get the point across to the US Department of Defense that we needed to get a grip on the massive amounts of data we were collecting from aerospace sensors: the phrase was, 'we are swimming in sensors, so we need to avoid drowning in data'. Today, on a daily basis, we only process about one to two per cent of the data our sensors collect!

The solution to that challenge was, and still is, the application of artificial intelligence to data analysis. An example is what has been going on in the US military with Project Maven, using AI to accomplish change detection in analysing Full Motion Video.[3] But its application goes far beyond that as AI will enable a variety of new military concepts of operation. One that is currently being researched is the 'loyal wingman' idea, which allows for automated control of uninhabited aircraft in a variety of roles dramatically expanding the capability and capacity of aircraft. The more complicated the battlespace, the greater the demand will be for those 'wingmen' to have algorithms that allow them to respond in cases where the coordinating human controller cannot directly guide them. Swarms of aircraft will similarly require AI for coordination.

Most importantly, AI is the key that will allow its wisest application to be executing our observe, orient, decide, act (or OODA) loop faster than an enemy can execute theirs.

Directed energy

Today, with modern air power operating inside the atmosphere, we can impose kinetic effects at the speed of sound. With the maturing of hypersonic weapons, we will be able to do that at multiples of the speed of sound. However, imagine the ability to impose kinetic effects at the speed of light. The realization of the routine employment of directed energy weapons will truly be game-changing for our air forces. If the long-awaited and often promised but, as yet, not materialized maturation of directed energy weapons becomes a reality, these weapons will eliminate the distinctions between fighters, bombers, and every other anachronistic characterization of military

aircraft that possess effective directed energy weapons, as they will be able to conduct both offensive and defensive missions regardless of the character of the aircraft hosting them.

Now consider the application of directed energy weapons to spacecraft and their potential to impose kinetic effects inside the earth's atmosphere—both to vehicles on the surface and in the air. Using directed energy from spacecraft to achieve kinetic effects against other objects in space will probably be realized before directed energy is militarily effective inside the atmosphere. That day is rapidly approaching. It is likely a matter of years not decades before such weapons are in place and ready to be used by one or more powers capable of creating them.

Even before the maturation of directed energy *weapons*, powering uninhabited aircraft via laser beams could very soon increase endurance and allow larger payloads, with high-bandwidth data sent back over the same beam.

The ubiquitous and seamless sharing of information

Any assessment of the likely landscape of future conflict must recognize that no matter what type of engagement, the outcome will increasingly be determined by which side is better equipped and organized to gather, process, disseminate, and control information. Desired military effects will increasingly be attained through the interaction of multiple systems, each one sharing information and empowering one another for a common purpose. It is a concept that can be envisioned as a 'Combat Cloud'—an operating paradigm where information, data management, connectivity, and command and control are core mission priorities.

This vision represents an evolution whereby individually networked platforms transform into a broader system-of-systems enterprise integrated through domain- and mission-agnostic information linkages. This approach will not only change the way we define new requirements, but more importantly, the way we think, command, control, and operate those systems. This is the essence of the Combat Cloud: it is not just the network, it is the entire enterprise of sensors, shooters, and connectors all part of a cohesive, coherent whole, and while it will extend across all operating domains, air and spacecraft will be the centrepieces of this architecture.

Cyber operations and electronic warfare

The intersection of cyber operations and electronic warfare will grow and in doing so will play an increasing role in contributing to the capabilities of the Combat Cloud. Desired effects achievable with offensive cyber operations are fundamentally challenging the traditional model of combined arms warfare and indicate the need to shift to a combined effects approach.[4] The combined effects construct puts cyber operations and electronic warfare on the same level as operations in the natural domains, treating

them as principal means of warfare, not simply supporting elements as they are under the old combined arms construct.

There are other promising technologies that we are yet to imagine but are sure to hold breakthroughs just as dramatic as was supersonic flight, operations in space, precision weapons, low observability, and others.

The major challenges of deploying, employing, and sustaining expeditionary forces across the globe are two-fold. First there is the fundamental difference in the nature of air and surface forces. Air forces can be rapidly deployed and employed anywhere in the world in a matter of hours, even from thousands of miles away. Surface forces—of both land and sea—unless pre-deployed to the specific area of concern, take weeks or months to deploy depending on the size of the force elements required. Second, as I mentioned earlier, the explosive growth in the ease and speed at which strategy, ideas and technologies are created and spread around the world has yielded new, more unpredictable threat environments. Rapid advancements in the capabilities of our potential adversaries all present unique challenges and expose vulnerabilities. Our ability to deploy, employ, and sustain forces to areas needed for deterring or countering malicious actors or adversaries is becoming ever more contested.

The spread of advanced technologies, enhanced by rapid advances in computing power, places increasingly sophisticated capabilities in the hands of potential adversaries as well as ourselves. The range and scale of possible effects with these new capabilities present a new military problem set that threatens the Allied expeditionary warfare model of power projection, freedom of action, and manoeuvre, and as a result begs for new operational concepts and doctrine to exploit advancing technologies in a fashion to deter and, if necessary, defeat future adversaries. So, let's take a look at just what those new operational concepts and doctrine might be.

OPERATIONAL CONCEPTS AND DOCTRINE

One of the most significant changes in the evolution of modern warfare is the result of the impact of the combination of three technological changes: 1) modern Intelligence, Surveillance and Reconnaissance (ISR) yielding persistent multi-spectral ISR; 2) the normalization of the use of precision weapons; and 3) the dramatic improvement of system survivability (stealth). This combination has resulted in the reversal of the traditional paradigm of the use of air and surface forces to defeat adversaries.

The traditional warfighting paradigm of surface forces leading the fight while supported by air forces has been supplanted by a construct where air forces supported by surface forces is often a much more responsive, effective, efficient, and less costly—in terms of both lives and dollars—manner in which to conduct warfare.[5] Validating this observation, a platoon leader during Operation Iraqi Freedom in 2003, at the leading edge of the

push to Baghdad by the 1st Marine Expeditionary Force, wrote: 'For the next hundred miles, all the way to the gates of Baghdad, every palm grove hid Iraqi armor, every field an artillery battery, and every alley an antiaircraft gun or surface-to-air missile launcher. But we never fired a shot. We saw the full effect of air power. Every one of those fearsome weapons was a blackened hulk'.[6]

In the context of this paper, the point of raising this realization is not to start a doctrinal roles and functions fight between armies and air forces, but rather to highlight the fact that capabilities change over time and the fundamental causes should be exploited to peace-loving allies' warfighting advantage. This is particularly true in an era where adversaries are working hard to negate the warfighting advantages we have exhibited over the past quarter of a century.

To best meet the challenges of future-peer and near-peer adversaries we must continue to exploit modern ISR, routine precision strike, improvements in survivability, and manoeuvre by focusing on two key essential actions. First, unshackle the surface-centric organizational paradigms of the past and embrace more functional joint and combined organizational constructs that can be achieved by greater integration of service components. Second, rapidly capitalize on the capabilities of the information age to actualize the ubiquitous and seamless sharing of information across systems in every domain as a vision of our collective militaries.

We are at a critical juncture in history. We are at the centre of an 'Information in War Revolution' where the speed of information, advance of technology, and designs of organizations are merging to change the way we operate. This change has dramatically shortened decision and reaction times and reduced the number of weapon systems needed to achieve desired effects. In World War Two it took months of time, thousands of airmen, and hundreds of aircraft to neutralize a single target. Today we can find, fix, and successfully engage multiple targets with a single aircraft within minutes.

Since the introduction of mechanized technology in the early twentieth century, the scale and scope of combat has been governed by industrial means of power projection. Advances in aircraft, ships, and ground vehicles increased speed, reach, and precision, but 'mass' remained an essential aspect of force application. In the twenty-first century, we face another technology-driven inflection point that will fundamentally reshape what it means to project power. *Advancements in computing and network capabilities are empowering information's ascent as a dominant factor in warfare.* No longer will it be sufficient to focus on simply managing the physical elements of a conflict—planes, satellites in space, tanks, amphibious elements or ships at sea.

These individual platforms have evolved from a stove-piped, parochial service alignment to a loosely federated 'joint and combined' construct today. To be effective in the future,

these same forces must become a highly integrated enterprise collaboratively leveraged through the broad exchange of information. Said another way, desired effects of military operations will increasingly be attained through the interaction of multiple systems, each one sharing information and empowering one-another for a common purpose—the Combat Cloud.

While mechanical technology will continue to serve as a key factor in future military operations, the information empowering these systems will stand as the backbone maximizing their potential. As the Combat Cloud is developed, it promises to afford an expansive, highly redundant defence complex with radically enhanced data gathering, processing, and dissemination capabilities. These attributes will offer actors at every level of war, and in every service component, dramatically enhanced situational awareness by transforming masses of disparate data into decision-quality knowledge.

This approach will not only change the way we define new requirements, but also more importantly, the way we think about operations, intelligence, command and control, and support. A distributed, self-forming, all-domain Combat Cloud that is difficult to attack and self-healing when attacked significantly complicates an enemy's planning and will compel enemies to dedicate more resources toward their defence and offense. In its ultimate instantiation, Combat Cloud will: 1) be strategically dislocating to any challenger; 2) provide conventional deterrence to a degree heretofore only achieved by nuclear weapons; and 3) enable operational dominance in multiple domains.

Turning this vision into reality will require a significant effort. While many militaries are evolving toward informationized forces, the integration and assimilation of related capabilities is incomplete. Forces are still predominantly organized, trained and equipped to fight a mechanized war—one in which information integration is a secondary support function. Most bureaucratic organizations and current programs of record reflect the linear extrapolation of the combined arms warfare construct developed in the industrial age of warfare. Program oversight efforts within our respective ministries of defence are also lagging—with antiquated industrial-age governance impeding information-age endeavours. Furthermore, with budget austerity as the new normal, our militaries need to devise more effective and efficient means to secure desired effects with existing capabilities. The Combat Cloud concept is a paradigm that allows us to do this.

If we are going to win the next great war, we need to gain persistent access to data networks while denying this same capability to any adversary. To be serious about this effort, military services need to embrace doctrinal and concept changes to how their forces are organized, trained, and equipped. The concept of the Combat Cloud stands as a framework to empower this vision.

Commanders must change the way they view networks and information systems. Rather than value only the weapons and platforms that launch them, commanders need to recognize the value of the effects they can create based on the seamless sharing of information. This shift in perspective will involve much more than simply material changes involving technology. Indeed, this is a completely different way of thinking about how we will use weapon systems in the future.

We need to think beyond the constraints that traditional military culture imposes on new technology. For example, fifth generation aircraft such as the F-22 and F-35 are termed 'fighters,' but technologically, they're not just 'fighters'—they are F-, B-, A-, E-, EA-, RC-, AWACS-22s and 35s. Similarly, the new 'long-range strike bomber, or 'B-21', will possess capabilities much greater than the 'bombers' of the past. These new aircraft are actually more properly described as flying 'sensor-shooter-effectors' that will allow us to conduct information age warfare inside contested battlespace whenever we desire—if we fully exploit their 'non-traditional' capabilities to the degree that those capabilities become accepted as the new 'traditional.'

Modern sensor-shooter-effector air and spacecraft are the key elements and will become the nucleus of the Combat Cloud because of their rapid reach and global perspective that only air power affords. However, this is not merely a recycled vision of net-centric warfare applied to air and spacecraft. It is a concept where *every* friendly force object and person is a component, router, and node in a real-time information-based constellation with low latency to enable accurate desired effects against priority targets.

The Combat Cloud as an operating paradigm will require an entirely different methodology for the command and control of air power along with the weapons and forces operating in the other domains. Command and control must keep up with the changes imposed by three major interrelated trends: emerging threats, new technologies, and the increasing velocity of information. The changes in these three areas since the design and establishment of our current Air and Space Operations Centers have been dramatic.

So much so that as a result of modern telecommunications, and the ability to rapidly transmit information to, from, and between various levels of command, there are many examples of 'information age' operations where tactical level decisions were usurped by commanders at the operational and even strategic levels. In fact, post-Desert Storm, most air power engagement decisions that involve lethal force have been pushed to the highest levels of command. This has occurred for a variety of reasons and is worthy of a book, but I'll get to the point.

This devolution of the air power command and control tenet of centralized control—*decentralized* execution, to one of *centralized* control—*centralized* execution, has

caused reduced effectiveness in accomplishing air power mission objectives. Recall that this was the *Soviet* construct of command and control, and while it might work in permissive airspace in small scale operations, in contested airspace in large-scale operations it is sure to fail—we demonstrated that in Desert Storm when Iraq employed that doctrine. Commanders must discipline themselves to operate at their respective command levels if air power is to realize its potential in the future.

The challenges of emerging threats, information velocity, and advanced technologies demand more than a mere evolution of current command and control paradigms, but rather a new approach that capitalizes on the opportunities inherent in those same challenges. We cannot expect to achieve future success through incremental enhancements to current command and control structures—that method evokes an industrial-age approach that has lost its currency and much of its meaning. The requirements of information age warfare demand not 'spiral development', but modular, distributed technological maximization that permits and optimizes operational agility. That kind of agility will not be achieved without dramatic changes to our current air power command and control concepts of operations.

In order to capitalize on the advantages of moving to the distributed paradigm of the Combat Cloud, we must move toward *distributed* command and control, and shift to an evolved version of the 'centralized control/decentralized execution' model to one of 'centralized *command*; *distributed* control; and decentralized execution.' I will leave the details for another paper but suffice it to say that command and control of air power is fundamental to its success, and it must be adapted to become more agile and rapid if the Combat Cloud is to be optimized to its fullest potential.

With respect to Allied interoperability, partners around the world are modernizing their armed forces with new military capabilities that have the potential to enhance the effectiveness of a Combat Cloud-enabled force. Specific systems include F-35, Typhoon, Rafale, Aegis-equipped ships, P-8, Wedgetail, Eurohawk, the new Tempest combat aircraft, and others. Transforming these individual weapon systems into collaborative elements of an interdependent operational enterprise is what the Combat Cloud is all about. Whether discussing technical standards, common training standards, or established operational tactics, the potential afforded by individual Allied systems will only be realized if they are harnessed in an organized, deliberate fashion.

In the future we must possess an agile operational framework that enables the integrated employment of joint and Allied military power. It means taking the next step in shifting away from a structure of segregated land, air, and sea warfare approaches to truly integrated operations. The central idea is cross-domain synergy. The complementary employment of capabilities in different domains, instead of merely

additive employment, is the goal—such that each capability enhances the effectiveness of the whole and compensates for the vulnerabilities of other assets.

Transitioning from industrial age, platform-centric methods of force employment to a combined-effects approach of interconnected, information-driven actions involves numerous challenges. It will require a review of, and appropriate changes to doctrine, organization, training, material, leadership, personnel and education, facilities, and policy to define a 'template' to guide the following: modernization policy, acquisition and concepts of operation; seeking collaborative solutions among the services; moving from measures of merit that replace cost per-unit to cost per-desired effect; eliminating stove-piping of kinetic and non-kinetic options; developing reliable, robust, and anti-jam means of communication and data transfer; creating sufficient diversity of employment approaches to avoid single points of failure; and realizing automated multi-level security to ensure coalition participation.

The Combat Cloud inverts the paradigm of combined arms warfare—making *information* the focal point, not the domains in which the military operates. This concept represents an evolution where individually-networked platforms—in any domain—transform into a 'system-of-systems' enterprise, integrated by domain and mission-agnostic linkages.

That said, air power has already evolved to become the indispensable force in modern warfare, and it will only grow in capability and criticality in offering options for the solution to the wicked security challenges that lie ahead. In the future we should not be bound by the historical limitations of surface warfare-based doctrines of air power supporting ground forces, but rather need to advocate and articulate the tactical, operational, and strategic advantages of engagement options where air power is the key force supported by surface forces. Dr Phil Meilinger succinctly highlighted this point in his recently published book on air power, asymmetrics, and a new strategic paradigm where he states: 'We must constantly search for new ways of fighting, and not merely using new weapons to fight in the old ways'.[7]

Given the entrenched position of the predominance of surface warfare officers in command of militaries around the world—particularly noticeable in the US military over the last 17 years—will the security options and capabilities that air power yield—even as they expand in scope and scale—be recognized and considered by national leaderships with the responsibility for military engagement?

AIR POWER ADVOCACY AND EDUCATION

In the early 1900s, pioneers of aviation sought freedom from many of the restrictions which burdened their peers. They slipped the surly bonds of earth to introduce to the world a new power—air power. In April 2018 we celebrated the 100th anniversary of the

Royal Air Force (RAF). Last year we celebrated the US Air Force's 70th anniversary as a Service proper, and it was also the 110th anniversary of US military air power—it was in August of 1907 that the first US military organization was formed with a specific focus on air power. That organization was the Aeronautical Division of the US Army Signal Corps. It was the precursor of today's US Air Force, and at that time it had exactly 10 balloons that were used to conduct reconnaissance—the equivalent of modern-day ISR you might say.

In 1908 they acquired their first dirigible and a trial aeroplane, and in 1909 the US Army purchased an improved Wright Flyer that was formally inducted into service—they named it 'Airplane Number 1.' This is the kind of creativity the US Army is still known for today. Joking aside, it is impressive to note that it was only four years after the first documented flight of a manned aircraft *in 1903*, that air power's military potential was formally recognized with the establishment of that first flying unit in 1907. That is the kind of forward thinking, of pushing the envelope, and of advancing established boundaries, that has been the hallmark of military air power, and of airmen, ever since. It occurred because pioneers with a vision for the potential of air power that was yet within reach strongly advocated for and successfully articulated those theories—theories of air power that far preceded its actual capabilities.

Today air power technology has caught up with—and to a degree, bypassed—early air power theory and the potential exists to dramatically expand the effects of air power as a means to achieve security goals and objectives. To do that, however, will require the same degree of boldness and courage of the pioneers of air power to initiate, develop, articulate, and to effectively advocate for those air power capabilities.

We have a complex series of security challenges facing us today. We are not going to buy our way out of these challenges—the money isn't there—nor are there any silver bullet solutions. We are not going to blast our way out of these problems with overwhelming force, as we no longer have the force structure we enjoyed in the past. We are going to have to *think* our way out of these problems and to succeed we need to exploit one of our greatest asymmetric advantages—the brains of airmen.

Our respective nations' airmen need to expand their vision, understanding, and knowledge of all things air force, but most importantly, to completely understand the fundamentals of why air forces exist as independent services, educate others as to the potential that air power offers, fight for a seat at the table where force employment options are decided, and strongly advocate for air power options where they are most appropriate. Unfortunately, the record of the last two decades is not positive with respect to any of these four elements. The reasons are complex and beyond the scope of this paper, but here are a few to consider.

First, an incorrect understanding and application of 'jointness' (or 'jointery', depending on which side of the Atlantic you reside). Since the 1986 passage of the Goldwater-Nichols Act in the United States, a joint approach was to move contingency organizations and operations from independent, de-conflicted, service-oriented approaches to sustained interoperability. Other nations adopted this approach. How well militaries have done that, where we are today, and where we ought to be heading, could and should be the subject of a thesis, but suffice it to say, the degree of jointness exhibited since 1986 has ebbed and flowed based on the commanders in charge, and the degree—or lack thereof—that senior-most military leadership encouraged joint organization and execution. The rationale and purpose of jointness is well-intentioned and optimizes the use of service component forces *if* properly understood and defined.

Jointness means that among our separate services, a distinctly developed and highly specialized array of capabilities is provided through service or functional components to a joint or combined force commander—his or her job is to assemble a plan from among this 'menu' of capabilities, applying the appropriate ones for the contingency at hand, and each contingency will be different. It does not mean separate services deploy to a fight and simply align under a single commander. Nor does jointness mean everybody necessarily gets an equal share of the action. Jointness is recognizing that to be joint we require separate services, and that it is an *imperative* that service members understand how to best exploit the advantages of operating in their domains. Articulating the virtues and values of your service *is being joint*.

Jointness is not homogeneity—it is not 'going along to get along'. It *is* recognizing that to be joint we require *separate* and distinct services, and that it is crucial that leadership understands how to best exploit the advantages of operating in those domains. The reason joint or combined force operations create synergies is because this approach capitalizes on each services' core functions—functions that require much time, effort, and focus to develop the competencies required to exploit operations in their respective domains. There are many leaders out there that don't understand that to have jointness, the separateness of the services is a requirement. It takes 25 years to hone the expertise to be a great division commander on the ground, a battle group commander at sea, or a joint force air component commander. The construct of joint operations requires that we have strong and competent armies, navies, and air forces.

However, to capitalize on the potential of the true value of jointness, air forces need to have a seat at the table in option development, planning, and execution of joint operations—and command of forces and organizations where most appropriate. These conditions have suffered over the past quarter of a century—at least in the United States—and they need to be corrected.

To understand the state of affairs in this regard, there was a lack of real joint organization in Iraq and Afghanistan. More often than not a 'J' was simply put in front of an Army organization and that was it. Joint Task Force (JTF) Mountain in Afghanistan only had Army personnel assigned; there was a multi-national *CORPS* Iraq, but no JTF-Iraq; in Afghanistan there was an International Security Assistance Force, and US Forces-AFG, but there was never a JTF-Afghanistan, with associated service components.

This absence of real 'jointness' in the first decade of the twenty-first century has continued into the second and manifested itself in the current organizational structure of Operation Inherent Resolve. When operations against the Islamic State started in 2014, the President of the United States clearly stated that there would be no US ground forces involved in combat operations in Syria or Iraq. The only US force involved in combat operations—with the exception of a small number of special operations forces—was air power. However, the commander of Joint Task Force Operation Inherent Resolve has been an Army *corps* commander for four iterations to date. The Army CENTCOM commander would not put an Army Division commander in charge of a Navy aircraft carrier battle group but yet has no problem with putting an Armor Corps commander in charge of an air campaign.

Perhaps if there was an airman in charge, the air operations against the Islamic State would have been designed as an air campaign against a state, rather than as a continuation of the counterinsurgency campaigns of Operation Iraqi Freedom and Operation Enduring Freedom that were the experience of the Army commanders in charge. Perhaps then the Islamic State would have been nullified in four months instead of taking four years. Completing that operation rapidly we would not have given the Islamic State the gift of time—over four years to perpetuate their ideology of evil and spread it to over 30 additional countries; or time to migrate terrorists out of Syria; or time to commit the slaughter of innocent men, women, and children in the region.

The Army-dominated CENTCOM leadership is on the record many times saying this would be a long-term endeavour. That is how armies think because they generally move at the speed of infantry—single digit miles per hour. It takes a division commander in the Army 25 years to master the terrain that a lieutenant in the Air Force flies over in 90 seconds—think about that and its implications for operational approaches to campaign design.

Every service component leader has a moral obligation to think of the best way they can achieve desired effects in support of desired national or coalition aims. Top leaders can assess which option is favourable. When a service surrenders their voice in this process, they may be putting the nation or coalition at risk, and putting lives unnecessarily in danger if their approach, which may have never gotten to the senior decision-makers, was actually a better option that could secure objectives and save coalition lives. Back in

1930 Billy Mitchell succinctly stated: 'The advent of air power which can go straight to the vital centers and entirely neutralize or destroy them has put a completely new complexion on the old system of making war'.[8]

Who is speaking like this in the air ranks today? Who offered the alternative of rapidly terminating the Islamic State's ability to effectively function by rapidly crushing them in Syria as a first priority as opposed to rebuilding the Iraqi Army and then assisting it in regaining lost ground in Iraq? I posit that in Operation Inherent Resolve the latter could have been accomplished much quicker if an air-based strategy against the Islamic State in Syria was selected over the ground-based strategy applied that treated air power as simply aerial artillery.

In the interwar years of the 1920s and 1930s, airmen pioneered aviation technology, then devised concepts of operation around the potential of that technology and followed that up with associated air power doctrine. The value of this progression of technology, concepts, and doctrine was seen in the post-Second World War Strategic Bombing Survey assessment, which concluded that the air campaign was a 'decisive' factor in securing the Allies' victory over Germany. Thank goodness airmen of the time articulated and fought for that option. Where and who are those airmen today?

We should all be very mindful that a generation of occupation-based, ground-centric strategies seeking to win hearts and minds that have different perspectives, and trying to turn sixteenth century tribes into modern democracies, has created a dearth of articulate air power practitioners and advocates in the ranks of our armed services. Airmen of the past two decades have been lured into a mould of compliance and silence. Compounding that compliance in the United States, was when US Air Force leaders in the first decade of the twenty-first century did advocate for a strong air force they were promptly removed from office.

The failure at the strategic level of the last nearly two decades of Army doctrine in multiple iterations should have lit a fire in the air power community—airmen should have been striving to seek optimal alternatives. However, airmen articulating alternative options have been missing. I believe that can be attributed to a fundamental misunderstanding of jointness as I described above.

As a service, the US Air Force went for nearly four years between 2006 and 2010 with not one Air Force officer in ANY of the top 11 positions in the Pentagon. Four years. The Chairman, the Vice Chairman, the Director of the Joint Staff, nor the J1, 2, 3, 4, 5, 6, 7 or 8. Since the establishment of *regional* Combatant Commands in the US—the warfighting commands—there have been a total of 107 commanders. Only seven have been Air Force officers. That is less than seven per cent of the regional Combatant Commanders in the *entire history* of the Department of Defense who have been from

the Air Force (and five of those seven were put in place within the last seven years, which is a result of a concerted effort on the part of several recent Air Force Chiefs of Staff to assist the Department of Defense to become more joint).

The family of US joint doctrine publications has a volume on petroleum and water distribution (Joint Publication 4-03), but none on strategic attack. Why is that? Because the other services are threatened by the thought of air power used in a fashion other than in support of surface warfare. And the most egregious recent example is that the most qualified, experienced, and knowledgeable senior officer in the entire US military in the Pacific area of operations was not nominated as the next Commander of Indo-Pacific Command in 2018, simply because he was an Air Force officer. Of course, a Navy Admiral got the nomination—never mind he only had one tour as a junior officer in that theatre.

These are but a few examples of symptoms that are a result of a lack of advocacy, articulation, and engagement by airmen since 9/11, and a lack of proper understanding of jointness. If we are going to optimally exploit the virtues and values of air power to meet the challenges of the future, our security establishments need a proper understanding of why independent air forces exist, a proper grasp of jointness, and a sense of airmindedness that all air force members should embrace as a foundation of their being.

These examples bring to mind a quote that seems appropriate: 'If you're not at the table, then you are on the menu'. It is well past time for air forces around the world to get off the menu and start talking turkey—not being the turkey. Airmen need to think like architects—not bricklayers. They need to relate to bringing vigilance, reach, and power to whatever task they are given, not just offer solutions of weapon system a, b, or c. Air Force members today need to fully appreciate that they are *all* 'airmen' first with a connection to an enterprise much larger than their particular specialties. This connection is inherent in the unique way in which we *think*, more than it depends on the particular job we first learn entering the air force. Early proponents of air power called it 'airmindedness.'

Air power is based on the characteristics of technology—but the invention, development, and application of those instruments flow from human imagination, and knowledge. Air forces seize on the virtues of air and space *to project power without projecting vulnerability*, and as a result it can provide our nations with strategic alternatives simply not available any other way. But to do so we need to create a culture and environment that *encourages* disruptive thinking instead of *discouraging* it. Our air forces were founded as a result of disruptive thinking, but at the beginning of the twenty-first century, our air forces may have fallen into complacency in that regard as a result of the pressure of what I call 'joint political correctness.'

We are not going to meet the budget challenges of the future by simply buying less of what we already have—we need to embrace and invest in innovation, creativity, and change. But is the military today walking that walk, or not? Have we become too risk-averse? How would Hugh Trenchard, Clément Ader, Hugh Dowding, Billy Mitchell, or Bernie Schriever act today if they were still alive? I think they would be trying to change our current surface-centric military culture to one that embraces the advantages of operating in the third dimension of aerospace as a *primary* means of securing our objectives, not simply one of supporting another medium of operations.

Air power options shape, deter, and dissuade so we can attain fundamental interests while minimizing the need for combat operations. When combat *is* necessary, aerospace capabilities yield a variety of strategic, operational, and tactical effects that provide disproportionate advantages.

In some nations, each of their services possess air *arms*—the Army, Navy, and Marine Corps. Those air arms exist to facilitate their parent services' core functions—their mastery of operations on the ground, at sea, or in a littoral environment. However, nations have only one Air Force. It is not just another air arm; its *reason for being* is to exploit the advantages of operating in the third dimension of air and space to *directly* achieve their nation's security objectives. It is this unique and specific focus that makes aerospace power an *asymmetric* advantage.

Airmindedness is the perspective that seeks how to best apply air power to meet nations' security objectives. It also encompasses how to effectively articulate those capabilities so our military and national political leadership incorporate them as alternatives of choice.

CONCLUSION

The challenge before us is to transform *today* to dominate an operational environment that *is rapidly evolving*, and to counter adversaries who *are rapidly advancing in capability*. In the face of disruptive innovation and cultural change, the military can maintain the status quo, or it can embrace and exploit change. I suggest that the latter is preferred.

Our services need to learn better how to rapidly adapt new technology to the innovative concepts of operation that technology enables. Our intelligence community, military, and other security institutions will suffer if their internal organizations fail to adapt to new, disruptive innovations and concepts of operation.

Just as combat tomorrow will look different than it did yesterday, so too should the military with which we prosecute it. We should take maximum advantage of the asymmetric capabilities our nations possess with their air forces operating in

conjunction with their land and maritime forces in innovative ways. A concerted focus on further developing and expanding air power capabilities and capacities would serve our Allied nations well, as they are uniquely positioned to underpin the kind of defence strategy and force structure appropriate to the future.

Airmen embrace the ability to rise above the constraints of terrain, literally, and to transcend the strictures of a horizontal perspective. As air power perspectives moved into space, a theory of the indivisibility of *aerospace* power materialized as the technologies of air and space merged in application. By the end of the twentieth century, the evolved combination of air and space technologies enabled great accuracy and assured access from aerospace systems. This combination yielded a concept of operations to achieve control over an enemy's essential systems no longer defined simply by levels of destruction. Rather, by imposing very specific effects on an adversary from means employed from air, space, and cyber, air power can effectively impose *strategic control* over the outcome of a conflict.

It is a methodology that realizes an adversary's ability to operate as desired is ultimately as important, or even more so, than the destruction of the forces it relies on for subjugation. This effects-based or outcome driven approach to warfare expands the options for the conduct of warfare beyond the attrition and annihilation-based models that define surface warfare. Air power going forward holds the potential to accelerate and amplify this approach.

General Hoyt Vandenberg, the US Air Force's second Chief of Staff, concluded his final speech to the US Air University by saying, 'You have got to go out and preach the doctrine of air power and never give an inch on it. You will be places where you are going to meet people who do not understand air power, and you are *going to have to educate*'. I cannot think of a more appropriate note upon which to close and urge you to follow General Vandenberg's counsel—not just for the benefit of our air forces, but for the benefit of our nations.

NOTES

[1] In this paper the term 'air power' is used in its larger context of including all operations that take place in the third dimension above the surface of the earth. Operations in space—and to a large part in the cyber domain—are inclusive to the term 'air power.'
[2] Sensor-shooter-effectors are assets which combine traditional aircraft roles (such as fighter, bomber or reconnaissance) into one airframe.
[3] **https://dod.defense.gov/News/Article/Article/1254719/project-maven-to-deploy-computer-algorithms-to-war-zone-by-years-end/**.
[4] For more information on this concept see, Rokke, Drohan, Pierce, 'Combined Effects Power,' Joint Forces Quarterly 73, 2nd Quarter 2014.
[5] For a comprehensive treatment on this phenomenon see, *The Urgent Necessity*

to Reverse Service Air Land Roles, by Price T. Bingham, Joint Forces Quarterly 84, 1st Quarter 2017.

[6] Nathaniel Fick, *One Bullet Away: The Making of a Marine Officer* (New York: Houghton Mifflin, 2005), p. 289.

[7] Phillip S. Meilinger, *Limiting Risk in America's Wars: Airpower, Asymmetrics, and a New Strategic Paradigm* (Naval Institute Press, 2017).

[8] William Mitchell, *Skyways: A Book on Modern Aeronautics* (Philadelphia, PA: J. B. Lippincott Company, 1930), 255.