Dodging Gaugamela

Three Ways in Which We Invite Catastrophe—and How to Stop Doing So

Maj David Blair, USAF[*]

> *A great civilization is not conquered from without until it has destroyed itself within.*
> —Will Durant
> *Caesar and Christ*

One of the great ironies of world history is that nations which lack an enemy capable of defeating them often take on the task themselves. They are typically quite successful, for they know their adversary very well. We excel as our own nemeses. In Professor Durant's seminal work, he describes the fall of Rome as a result of the decadence made possible through its victories. In this is the true irony: Rome's victory itself paved the way for that city-state's defeat.[1]

In their book *Unrestricted Warfare*, Chinese colonels Qiao Liang and Wang Xiangsui apply this rule to us.[2] Recognizing our dominance, they develop a number of strategies to turn our strength into a liability. One of their leading contenders is, "Give the Americans something to throw money at, and they'll spend themselves to death," a strategy that the sociopolitical fascists in al-Qaeda attempted to employ remarkably well.[3] It is far easier to keep aircraft out of the sky by indirectly inducing cracks in wing spars and wing boxes than to pluck them out of the sky with fragile and expensive surface-to-air-missile systems.[4] And it's far easier to reduce the number of Americans en masse every Friday in retirement ceremonies and separations than to assault them in a well-defended forward operating base.[5]

Qiao and Wang's argument goes something like this: Americans love their luxuries. The ultimate luxury in warfare is zero casualties. Therefore, the Ameri-

---

[*] Major Dave Blair serves as an MQ-1B instructor pilot in Air Force Special Operations Command. Previously, he deployed to Operation Iraqi Freedom and Operation Enduring Freedom as an AC-130U pilot, an operational planner, and a remotely piloted aircraft liaison. A graduate of the US Air Force Academy and the Harvard Kennedy School, he holds a PhD in international relations from Georgetown University, where he wrote on transnational criminal networks, social network analysis, and organizational optimization and disruption.

cans will spend prohibitive amounts of resources to achieve zero casualties. So, if you can keep one or two wars simmering at all times, then America's military will unsustainably consume its materiel and its people outside combat, bureaucratizing itself to death. It wouldn't be the first time that strategy has worked, of course. I'm not quite sure how many Roman soldiers it took to get one outside the wire, but, like us, their inefficiency and overextension created a market for a Visigothic Blackwater. (As later Goths would instruct them, subcontracting out your security isn't the smartest idea.)

The bad news is that we all make the same mistakes; we all seem to find our way back to the same well-worn ruts. The invincible Roman legions are overcome by manpower, retention, and morale problems, just as the invincible Spartan Phalanx before them. The Spanish Admiralty, bureaucratized and overcentralized by decades of losing treasure galleons to the privateer Francis Drake, finds its war galleons broken upon Gibraltar by the admiral Francis Drake. The French emperor is undone at the freezing waters of the Berezina to the sound of Marshal Kutuzov's cannons and Tchaikovsky's bells, a victim of his own unwillingness to listen to a well-reasoned no.

The good news, on the other hand, is that we all make the same mistakes. There is nothing new under the sun; it is exceedingly unlikely that we will invent a new error. Therefore, let us ask the Ghosts of Empire Past to show us the errors of their ways so that we don't make them ourselves: Darius from Gaugamela, epitome of centralized control and centralized execution; the admirals of the Spanish Armada and their one-mistake Spanish Navy; and the Caesar's commanders, choosing quantity over quality and hardware over humans. The following is a distillation of lessons learned from the distant past, offered in the hope that we will not add our name to the roll call of eclipsed empires, at least in my lifetime or that of my children.

If You Don't Learn from Failure in Small, Manageable Chunks, You'll Learn All at Once with Interest—Most Likely When It's Too Late

A one-mistake air force is hardly historically unprecedented. Unfortunately, the one-mistake Soviet military was not exactly known for its brilliant strategists; neither was the one-mistake pre-Armada Spanish Navy known for its tactical innovators. A one-mistake military would send George Washington packing long before he made rank, along with a few other minor figures such as Napoleon, Alexander, Hannibal, and Temujin (better known as Genghis Khan). Occasion-

ally a Zhukov or Gorshkov will survive, but he succeeds despite the system—not because of it.

In US Air Force colonel John Boyd's masterwork "Destruction and Creation," the great airpower architect argues that organizational learning is as much a function of well-directed failure as well-directed success.[6] During Boyd's time, the Air Force set out on the "Zero Defects" iteration of the perennial campaign for perfection in metrics, demanding that units become "100% for zero defects." Seeing in the campaign the death of innovation and adaptation, in a variation on a theme, Boyd and his compatriots declared themselves "100% against zero defects."[7] In his later work, the late colonel describes adaptation as two opposing pistons—one the destruction of old frameworks and the other the creation of new ones, both working in concert to propel an organization along the all-important observe-orient-decide-act loop.[8] Boyd's model implies that an organization which makes no room for the destruction of old frameworks—one that does not allow for the possibility of imperfection—will stall just as quickly as an engine firing on one cylinder. Entropy is messy, but without it there can be no motion.

The problem with a one-mistake military is that it is remarkably brittle. Consider the Spanish Navy right before it was shattered upon Gibraltar. Spanish captains ruled the seas for a century, so perfection is expected from them. It makes sense, in a way: if you have the best galleons and the most galleons, there's no reason that you shouldn't be able to win any given engagement. So that becomes the standard—no longer excellence but omnipotence. Of course, attributes of divinity are difficult metrics to live up to, and a couple things begin to happen. First, since taking responsibility for a choice that didn't turn out perfectly is suicide in a one-mistake system, officers devise a way whereby nobody has to take responsibility for anything—committees. Decisions involve enough people so that if it doesn't happen to work out, the question "Why?" is readily answered with ambidextrous finger-pointing. Second, since the consequences of failure are necessarily greater for those without enough rank to insulate themselves, decisions migrate higher and higher up the chain of command, and tactical commanders become more and more disempowered. Much like the *condottieri*, bloated with impossibly heavy armor, the Spanish Navy was perfectly insulated from internal risk and completely vulnerable to a lighter, more maneuverable adversary actually capable of making decisions.[9] It was ripe for the plucking, and Queen Elizabeth was in a plucking mood—and the rest was history. You get one chance at the Spanish Armada, and if you bungle it, you have to deal with Napoleon's fool of a brother on your throne a few centuries later.

The problem isn't failure—it's how you deal with failure. Be it Zero Defects, Total Quality Management, or Six Sigma, it is simply unrealistic to expect a per-

fectly optimized war.[10] Precision in fixed, predictable processes is certainly a virtue. That said, war is fought in the great Prussian's fog, and tools that deal well with complexity are primary. We aren't making Toyotas, and the other side fights to win. As comfortable as it would be to throw Jomini's rules into a multiple regression, Clausewitz's "fog of war" always seems to find a way to botch things up. If you don't have the creativity, flexibility, and initiative to deal with that chaos, then no half-baked management textbook or computer program will allow you to defy 5,000 years of military history.

There are, of course, different kinds of failures, and in order to deal with failure, you need to differentiate among them. First, and most inexcusably, are failures by choice. Choosing to be negligent, choosing not to plan, and choosing not to learn are all failures by choice. The only purpose of these failures, as the demotivational poster states, is to serve as a warning to others. These should not be tolerated. Second are failures by chance. Even a perfect missile shot in the heart of the weapon engagement zone misses sometimes.[11] That's why it's called a probability of kill—because it's a probability.[12] Even if you play the odds perfectly, sometimes you draw a 22. These are simply the cost of doing business—a function of the fog of war. Lastly, and most usefully, are failures by concept. We will explore these presently.

Typically, defeat is a better teacher than victory. Unfortunately, defeat in combat is typically fatal. This is the point of exercises and war games: if you discover all your "failures by concept" in a nonlethal environment, you'll still be around to learn from them. If you can give a pilot his historically most dangerous first 10 combat sorties at a Red Flag exercise, he will have an opportunity to get his newbie mistakes out of his system before he actually goes over land in a war zone. If we made no mistakes, then Red Flag and the US Army's analogous National Training Center would be expensive irrelevancies; their ability to induce failure and expose weaknesses makes them so valuable.

Of course, the critical ingredient in all of this is the ability to learn from failure. Lacking this, a war game or training sortie becomes worse than worthless—*strategic negative training* is probably a good term for it. Remember that Admiral Yamamoto's devastating attack on Pearl Harbor was at least in part inspired by a US Navy exercise that simulated the same scenario. The war game turned out pretty much like the actual attack, but apparently the Admiralty of the time had more important things to attend to. Its enemies learned instead. According to the *Struggle for Naval Air Supremacy*, "The fact that Japan nearly duplicated this attack on Pearl on Sunday morning, 7 December 1941, was no accident. Early in the 1950s [a US Navy admiral] . . . dined in Tokyo with a Japanese vice admiral

who had participated in the planning. 'He told me they had simply taken a page out of our own book!' "[13]

I wonder how many potential great-power competitors are applying innovative concepts from our military journals to themselves more effectively than we are to ourselves. Necessity may be the mother of innovation, but military necessity is usually the result of some sort of strategic conceptual failure and is typically revealed in casualties. It is far less painful to learn from red markers than from blood, but you have to make the choice to face failure honestly. Only then will you find the impetus to innovate solutions.

Used correctly, "failure by concept" is the engine that drives organizational adaptation. (If ignored, it is the mechanism that creates organizational collapse.) One of the most important functions in a market economy is business failure. When the horse-and-buggy-whip factory goes under, all of its workers are returned to the economy to be retrained for more useful occupations. The factory owner, most likely, licks his or her wounds and goes back to the drawing board. He or she may very well become the next innovator in transportation technology. This is failure by concept properly employed: resources are released from failed concepts, lessons learned are captured, and the incentive to innovate is renewed. Failure by concept is the crucible for your future innovators; it is the manure that fertilizes the next evolution of your organization. As such, it should be valued and learned from, not punished. This is the lesson of the Spanish Armada: you can't give your people room to succeed without giving them room to fail. The trick is learning to do both well.

Using Metrics Unrelated to Strategy and Uncorrelated with Victory Will Lead to Defeat

It's one thing to lose a gauge in your cockpit and another thing entirely to have it feed you false readings. Most dangerous is the faulty gauge seductively telling you exactly what you expect to see, leaving you in a world of hurt without a clue. Metrics are the gauges for your organization. Unfortunately, unlike most of our newer electronic gauges, they don't have a built-in-test feature. You have to use the tried-and-true common sense built-in test.[14] Does this statistic jive with my sense of the organization? Does it fit with what I'm hearing from my troops? Does it check with the big picture?

As the old saying goes, there are "lies, darn lies, and statistics." The fact that you can quantify something doesn't mean it has any bearing on the reality of a situation. Statistics is a very powerful language, but it is a method of describing truth—not the truth itself. Consider the revolution of effects-based operations and the simple realization that actions have consequences in reality. We must

apply that revolution to the organization as a whole. Hundreds of incoherent metrics tied loosely to desired strategic effects won't help us recover from this unusual attitude. Like a good navigator, we can get where we need to go only by starting at our goal and planning backwards, and the first step from national objectives to individual unit metrics is strategy.

Strategy is the groundwork and the glue for proper metrics, yet strategies must be formed holistically. This is one of the present ironies of our current air corps: we are inherently strategic, but we seem to have a difficult time formulating coherent strategy among our disparate tribes. We are inherently strategic simply because we are too expensive to be used economically for anything other than generating strategic effects. Compare the sticker price for a B-2 or an F-22 to that of a tank or a soldier, and we must answer the taxpayers as to what their premium is buying. Modern aircraft are near the price range of major naval surface combatants. A carrier battle group is undoubtedly strategic; therefore, we must be as well. But we cannot confuse hypothetical strategies that justify institutional preferences with strategies that actually deliver on the taxpayers' investment. We must then consider how to deliver strategic impacts on complex real-world problems with our present and future tools as Airmen.

Strategic effects are simply a matter of properly sequencing tactical effects. Dropping a bomb on a building is a tactical act, but if that building happens to be a communications center, then the effects of that tactical engagement are almost entirely strategic. You didn't just blow up a building; you turned the radios of all your adversary tank commanders into paperweights, which allows the friendly tank commander to destroy them much more easily. The tactical and the strategic are intrinsically connected, but airpower is unique in its ability to create geometric strategic effects from arithmetic tactical strikes. This is the revolution that inaugurated the rise of the fighter generals in the 1990s: you don't need megatons of nuclear power to effect strategy; you just need to put chunks of conventional explosives at the right places in the right order. If Operation Desert Storm was the inauguration, then the "shock and awe" remix was the culmination. Perhaps, though, the opening phases of Operation Iraqi Freedom were both a masterpiece and a grand finale—an end of one way of war and the beginning of the next. Our adversaries seem to have grasped the new interplay between tactical strikes and strategic effects. As the saying goes, an improvised explosive device doesn't go high-order until it hits the news. Consequently, we must ask how our adversaries made the leap to the new strategic high ground of communications warfare and cultural knowledge before we did.

Strategy is all about where you start. As an aviator-centric community, we seem to start with platforms; no self-respecting pilot doesn't love his jet. From

platforms, we derive tactics; we celebrate tactics in patches and in promotions far more than our sister services. Lastly, from tactics we derive strategy. Unfortunately, because we build up from platforms to strategy rather than down from strategy to platforms, our strategies seem to center on platform communities. Be it the long reign of Strategic Air Command or the recent to-do with the F-22, we have a very difficult time thinking outside our communities.[15] This is a result of our inherent tension between subject-matter-expert-ship and leadership. A pilot must be good at flying an aircraft, yet an officer must be a leader, and these skills are not necessarily related. They may, at times, be in opposition: the subject-matter expert (SME) appropriately cares about his subfield and subcommunity above all else. The leader should value all of his subordinates' skill sets equally, regardless of his or her own background. This dichotomy increases with rank—we promote people for being SMEs, and then we expect them to leave the SME behind and become leaders and strategists when they take command. As long as technical operators (including aviators) play a major role in the destiny of our service, this is a tension we all have to manage.

From time to time, however, we have managed it brilliantly. Boyd was just as exceptional both as a strategist and a Super Sabre driver. Bringing the world of the SME and that of the leader together, he dreamed up an entire generation of aircraft to match the next generation of warfare that he envisioned. In the same vein, John Warden understood the technology of modern warfare in detail yet had a strategic mind capable of harnessing the power of that technology for the entire US Air Force. In this fusion of technology and strategic leadership, in a very real sense, we found victory in the Cold War. Checkmate was better than the Russians at being the Russians, and since we knew both our enemy and ourselves, we achieved Sun Tzu's ultimate prize—victory without fighting.[16] Are we better than our enemies at being our enemies? Would their best strategies look banal compared to our best simulations?

How do we get there from here? Well, strategy is the key to good metrics, but strategists are the key to good strategy. So we must develop strategists. One way to do this—and by no means the only way—is to consider the School of Advanced Air and Space Studies a field-grade strategic equivalent to the company-grade, elite, SME-oriented Weapons Instructor Course. With this combination of the two, we could intentionally develop once again the kind of strategists who allowed us to win the Cold War—the kind of thinkers who could take the ideas of effects-based operations and apply them to the organization as a whole, fusing disparate and largely irrelevant metrics into an accurate and complete strategic picture. Moreover, integrating security scholarship into a more robust professional military education program, one that incentivizes critical thought and

outside-the-box thinking, could carry the torch of analytical rigor to the whole service.

If You Choose to Game Your Metrics, Your Adversaries Might Just Game Them Too

A long time ago, in a Soviet Union far, far away, there was a man named Stakhanov. He was a one-in-a-million kind of guy—the best miner in the entire country, maybe the entire world. Apparently, he would regularly turn out 10 times his quota of coal, an amazing amount by anyone's standards. This, of course, reflected well on him, and on his boss, and on his boss's boss, and pretty soon they all found themselves promoted. Inevitably, the other bosses noticed, and they started looking for their own golden goose; some found one, and some made one. Pretty soon, Stakhanov copycats started popping up all over the place, at least on paper. The Soviet government, seeing a bunch of factories at 1,000 percent production, began asking the question "If they can do it, why can't everyone?" And the outlier exception became the standard expectation. It was an unrealistic standard, but the Soviets were never known for their love of objectivity or accuracy. So if you're a factory boss, your choice becomes simple: produce at 1,000 percent capacity or move to Siberia. Fortunately for them, there was an out. A command economy doesn't register value in profit—only in metrics, and metrics are notoriously easy to game. If you're a steel factory, steel is measured in length, so you make miles and miles of long, thin, and completely useless steel; if you're a glass factory, glass is measured in surface area, so you make acres and acres of glass so thin that it shatters upon any attempt at storage. Eventually, the plant bosses and their bosses and their bosses all the way up colluded in the deception, but the fact remained that the emperor had no clothes. Much later, by way of the Strategic Defense Initiative program and a few other things, the whole charade collapsed under its own weight.[17] Stakhanovism doesn't work.

Just as a thought experiment, imagine adding up the sum total of "money saved" between every performance report we produce each year. Or the sum total of resources that people are responsible for. Or the number of people in the top 1 percent of the US Air Force. It's the same paradox as Stakhanovism: if you don't inflate performance to an absolutely ludicrous level, you are ensuring that you and your subordinates don't get promoted and hence ensuring that those who do will be promoted in their stead and thus continuing the cycle.

There is more at stake here than integrity and our good name. You can game your metrics all you want, but at some point, reality shows up. The more you game your metrics, the more likely it is that reality will show up all at once. For the Soviets, it showed up as total economic collapse. For a military, especially one at

war, the stakes are even higher. All warfare is deception—and it is the height of foolishness to give your enemy a head start in that fight through self-deception.

If I were playing the bad-guy side of this long war, I would set up a few franchises to keep one or two wars simmering at all times. Then I would sit back and watch our side spend itself to death, deploying people who don't need to be deployed, flying sorties that don't need to be flown, making our numbers look great so we can award ourselves combat medals for sending e-mails. At some point, "sustained maximum surge" ceases to be a contradiction in terms and becomes a necessity, and the good-guy side sacrifices the initiative and the clock. After that, it's just a waiting game.

You have to fix it the same way you broke it. Metrics get decoupled from reality when they forget scarcity. Remember scarcity, and you will return to reality: frugality is the key to winning this long war. Spend resources and take strategic risks when the payoff is worth it; otherwise, make an equally strategic choice to preserve scarce resources (i.e., maximum surge is a strategic risk). We don't need to make this one up from scratch; we implement risk-control measures on the operational level with operational risk management—perhaps we can inaugurate strategic risk management.[18] One simple and critically important step involves rewarding commanders for choosing not to change things when change is not warranted and for choosing to say no when no is the right answer.

If Your People Become Just Numbers to You, Then You'll Become Just a Job to Them

It's always the enemy you don't see who kills you. Unfortunately, if you're on top, that enemy is often yourself. Manpower, morale, and retention become the nemeses of the hegemon; all other enemies can be dismembered with surgical strikes or crushed under a centurion's studded sandal, but the harder you fight, the more powerful these adversaries become. So it was with Rome.

Military historians call it the "victory disease." Winning is addictive, and if you win enough, you begin to forget the terrible consequences of losing. Sometimes it works out. During the Great Game, the Russian Empire inherited five "-stans" simply by setting a few ambitious and victory-addicted generals loose in Central Asia.[19] More often than not, though, it ends very poorly indeed. The two most obvious examples from the last century are Japan and Nazi Germany. By opening an unnecessary front with Stalin, Hitler casts away any real chance of victory; the hubris that grew from the slaughter at the Tsushima Strait ultimately proved the undoing of the Imperial Japanese Navy (despite the wiser urgings of Admiral Yamamoto). The disease, however, is not always seen in such stark terms.

Once you've run the board, the victory disease becomes much harder to detect. There is a difference between dominance and omnipotence, and forgetting that fact results in mission creep.[20] Leaders begin to forget that objectives must be constrained by available resources. Since saying yes has worked out so well so far, saying no begins to mean "don't promote me." Squeezing blood out of a turnip becomes a way of life; there's always a new "last big push," and it's never actually the last one: the last big push against Hannibal and the armies of Carthage, against the Macedonians, against Cleopatra and Mark Antony, against the Parthians, against the German insurgents, against the Judean rebels, and so on *ad exhaustium*. To paraphrase a contemporary quotation, it depends on what the meaning of *last* is. It took a toll: by the time Attila showed up at the Catalaunian Fields, the once-mighty empire found itself looking to erstwhile Germanic mercenaries for security. It's pretty hard, though, to convince a fast-burner consul general to forgo his chance at rank and glory for the sake of difficult-to-quantify consequences in some far-off future.

The consequences of these choices show up subtly, at least at first. The numbers look good until right about the end, and it's hard to quantify quality in the interim. The first thing you lose is your experience. The citizen-soldiers who've done their time feel no need to give more to some endless crusade of proconsular self-promotion that has little to do with their family's safety. In one not-entirely-uniquely-Roman situation, while citizen-soldiers were off defending their country, the fields left fallow in their absence were purchased by rich real-estate developers at well-below market rates. When they returned home, they had no choice other than pay far more for fields equal to the ones that were once theirs.[21] The ones who can leave start leaving. At this early point, though, replacing their numbers isn't much of a problem.

The next thing you lose is just as subtle—your quality. Your experience voted with their feet heading out; now your would-be recruits start voting with their feet by not coming in. As the bond between commander and soldier is abraded by ambition and strained by the faceless demands of the institution, you lose the warrior spirit that drew together Leonidas's 300, Alexander's Companion Cavalry, David's Mighty Men, and every other group worth naming. Unfortunately, if you drive away all the people willing to fight for the right reasons, you get the people willing to fight for the wrong reasons. Certainly, as US adversaries in this war clearly demonstrate, you can continue to recruit criminals and sociopaths for quite some time, but such as these are hardly a group you would want to entrust with your deadliest instruments of power. Alternately, you can outsource your security needs to mercenaries, but as the Romans discovered with the Goths, when you depend on mercenaries for your defense, they might renegotiate their contract

against your will. Regardless, you cannot get the Guardians of Plato's Republic unless you treat them like the precious resource they are, but you can still probably make your manpower metrics work—at least for a time.

The last thing you lose is just that—your numbers. By then, however, it's far too late. Your experienced warriors left long ago to tend to their long-neglected families and farms, and your quality would-be warriors found honorable alternative professions where hard work is tied to rewards and competence is valued over politics. Eventually, you find yourself in a particularly sanguinary retelling of the childhood fable about the boy who cried wolf. And so, on a summer day near the town of Adrianople, with legions of Germanic cavalry bearing down on him, the Emperor Valens finds himself in the middle of the actual "last big push" only to discover that there's nobody left. The brave warriors who defended the long-lost Republic are long gone, the military machine built on their backs has ground itself to bits in far-flung wars, and the dregs that were left are more than willing to switch sides in exchange for their share of the plunder. But I suspect that the numbers looked good right up to the end, along with the citations for their accompanying medals and promotions.

Machines (Including Bureaucratic Ones) Allow People to Win Wars, Not Vice Versa

The Soviet admiral Sergei Gorshkov once said that "quantity has a quality all of its own." I offer a corollary: quantity has qualities all of its own, and some of them are bad. Mass is a quality that cuts both ways. The Indian warlord Pururava learned this quite directly at the hands of Alexander at the Hydaspes. The chieftain brought an overwhelming number of troops to counter the Macedonian invaders and along with them a number of devastating war elephants. Unfortunately for him, devastating was a scalar quantity—not a vector quantity. Backing the Indian force against a river, Alexander and his Companion Cavalry managed to panic the elephants, who proceeded to trample much of the assembled Indian force. The moral of the story: panicked decisions made by large, detached organisms typically result in fratricidal, full-deflection control movements. Perhaps we might conceive of manpower or acquisition bureaucracies as our own mammoths.

What is true for bureaucratic machines is true for technological machines. Secret weapons and cutting-edge technologies don't do you any good without strategy. Alexander taught this lesson to Darius at Gaugamela, a battle that we will discuss at length later. The takeaway point right now is that technology is almost irrelevant when you don't integrate it properly into a battle plan. Darius brought two cutting-edge secret weapons to Gaugamela—scythe-armed chariots and war elephants. Unfortunately for him, chariots were a poor match indeed for

the defenses of the Macedonian phalanx, and the novelty of the elephants was lost on the unimpressed Macedonian troops, who found them as easily repulsed as horses by javelins. This is not to say that technology is unimportant—only that, in and of itself, it is not sufficient. German technology arguably outpaced the Allies through much of the Second World War, but much of their effort simply resulted in better prototypes for their soon-to-be Cold War adversaries.[22]

When technology is paired with strategy, it is quite effective, but machines cannot make strategy. The F-117 is an interesting Cold War novelty, but when paired with Warden's Five Rings strategy, it is a tremendous force multiplier.[23] Engineering and machines enabled a distinctively human strategy to succeed. The danger, especially for a service shaped by technophile aviators, is to see the aircraft as the end, in and of itself. We must remind ourselves that warfare is a solely human endeavor, fought by humans against other humans for human ends. Machines may be part of it, but they are not at the beginning and not at the end. Technology is not a silver bullet—merely a strategy enabler.

The historical story of David and Goliath is a tale of weapons technology, in a way. The Philistines, of which Goliath was one, were not a native Canaanite people group. Hailing from Mycenae, they were masters of advanced Greek weaponry. The Israelites, on the other hand, had inferior Canaanite weaponry, but they fortunately found a brilliant strategist in a shepherd boy. If bronze armor can't beat an iron spear, then take metal out of the fight entirely by turning it into a ranged contest. A slinger, the missile troop of the ancient world, wins from distance—and he did. Technology comes from the Greek *techne*, the word for *art*—a practice of people that allows them to accomplish a task. Technology is both the people and the metal—the humans and the hardware synthesized for a mission.[24] It is tempting but foolish to focus solely on the latter.

MiG Alley also speaks to the role of humans mastering hardware to master the battlespace. MiG-15s were slaughtered by Sabres simply because of better pilots (and a bit of hydraulics).[25] What piece of equipment on an aircraft has a greater impact on mission accomplishment than the crew dogs themselves? People aren't meat servos that allow technology to function; rather, technology is a tool to help warriors win wars. Perhaps a great special operations forces thinker said it best: humans are more important than hardware.

Talent Management Trumps Force Management: The Air Force Is a People Group, Not Just an Institution, and Shaping Culture Takes More Than a Spreadsheet

Hamilcar Barca, Hannibal Barca, Hasdrubal Barca. Julius Caesar, Augustus Caesar. Gen Victor Krulak, Gen Charles Krulak. Leadership is oftentimes expressed in a generational legacy. The construction of a military genius is a generational project, as is the development of good soldiers and good leaders. These generations are not solely bloodlines—Saladin and Zhukov had little-to-no military upbringing but certainly had mentorship. In modern terms, many promising young people who could no doubt become excellent lawyers, doctors, and airline pilots choose to forgo that higher standard of living because of a mentor or parent's legacy of service. Military families and mentors are a crucially important source for future warriors. If we expend that precious resource in the name of today's fight, we'll have little left for tomorrow's fight. By the looks of the road ahead, we may need good warriors tomorrow even more than we need them today. Stated simply, if you expend the families and friendships of today's warriors, you are borrowing against the future.

Regardless of your flavor of spirituality, your moral compass and spiritual bearings must come first. Then comes the most significant relationship in your life—your family. Lastly comes the entity that grants you the freedom to serve all of the above—your country. By defending your country, you ensure that you remain free to pursue a better world through your convictions and protect your family. So when you keep these three things in the right order, the math works out. Your best people will make sure that they keep these three things in the correct sequence in their lives; they fight well because they fight for the things they love—not vain ambition, careerism, or selfishness.

The problem comes when you start asking people to put these things in the wrong order: the math starts to fail. If you demand that people place country before family, then country starts becoming a threat to family. Some of your very best people will make that choice if you force them to choose. How many highly effective squadron commanders have we lost from the service when they turned down rank in order to put their marriages and their children first? How many remarkable service members in military-to-military marriages were forced to choose between children and a spouse's career? What if we never forced these comrades to make these sorts of choices?

Another formulation is "duty, honor, country."[26] To whom is your first duty? Whom must you honor first? Your best people and most effective leaders get this right. We lose these people if we ask them to get it wrong. Leadership starts in the

home, and if we value careerism over families, then we should not be surprised to find ourselves with careerists instead of leaders.

"To provide for the common defense." Those were the words that made us, not "workers of the world unite" or "until the world is free" and certainly not "for the glory of Rome." It's a pretty conservative mission statement, almost boring really: keep the people safe. It is the people themselves who are the glory of America. The archetypal American military hero is not the career general, festooned with medals and rich in power, but the Second World War veteran, surrounded by grandchildren, with his Silver Star on the mantel next to the photo of his 101st Airborne buddies. We fight and we win so that we can return to safer homes. We figured out relatively early in our history that when we fight together, we fight more effectively. Barbary pirates are much better fought on the shores of Tripoli than on the decks of individual merchantmen, so to defend ourselves and our families, we defend our country. Therefore, we must ask how well our country will be defended if we do not protect the families of service members.

Stated simply, the health of military families and the freedom of service members to reconcile personal and professional goals are not just a retention problem for today; they are a recruiting problem for tomorrow. It will affect both quality and quantity as the warriors of the future are shaped in the personal time of the warriors of the present through mentorship and parenthood. This is not some ancillary morale issue to be parceled out to unit leadership and services squadrons; this is a critical strategic metric of long-term sustainability. Preservation of military families and friendships is deep logistics, just as essential as access to strategic minerals or geographic choke points. They must be guarded as such—the next generation of the military depends on it.

Fortunately, a military that accommodates for the spectrum of choices that make for strong families or mentors is also a military that accommodates the unique and diverse sort of talented individuals who don't fit into cookie-cutter career trajectories. These sorts of individuals are whom we need to prevail in cyber and other ill-defined emerging fields of conflict—the sorts of people we want in these fights are those with great options and unique capabilities beyond the walls of the service. When pilots were faced with these options in the form of the airlines, we offered a huge bonus; the bonus for these uniquely talented people is optionality, not money. Therefore, retention metrics for Airmen with non-cookie-cutter, legitimate personal constraints are a good indicator of our ability to retain talent in general.

If You Disincentivize Decision Making,
You'll Make Leaders Who Can't Make a Decision

"You get the behaviors you incentivize." This truism of organizational behavior raises one simple yet critically important question: what are we incentivizing? Of course, before we can answer, we must consider its antecedent: what should we incentivize? For that, we return to history.

"What shouldn't we incentivize?" is in many ways an easier question. Let's start there. For one glaring example of failure by design, we turn to the Soviet military of 1940, freshly gutted by Stalin's purges. Conspicuously absent are the traits that make great commanders—leadership, initiative, command presence, and innovation. Unfortunately for countless would-be great commanders, initiative and innovation were heresy to the new people's establishment; command presence and leadership made you a potential threat to Comrade Stalin, and either way the only thing you would go on to command was a pickax in Siberia. The path to success was never to be last and never to be first either. Safely ensconced in the gray middle, the powers that be would never see you as a threat to their power, and if you just survive long enough, you'll get promoted simply by seniority. Mediocrity became a survival skill, and not surprisingly, the Soviet military establishment soon came to celebrate mediocrity. The incentive structures put in place by Stalin achieved their desired goal: the military could in no way pose a threat to him. Unfortunately for Russia, neither could it pose a threat to an invader. This fact was amply demonstrated in the opening phases of Operation Barbarossa, during which uniformed Soviet bureaucrats were trounced time and again by the tanks of the Third Reich.[27] Fortunately for the Russians, a few actual commanders somehow survived the purges and went on to lead the Red Army to victory. Still, one has to wonder how many would-be Marshal Zhukovs were stuck counting trees in prison camps and how many lives could have been saved if these men had been given the commands they deserved.

For a bit less malignant but equally catastrophic example of perverse incentives, we turn to King Darius of the Persians. Gaugamela is a more complex scenario, but I believe it fits our present dilemma much better. Persia was the unquestionably (until then) dominant power of the age, possessing the largest armies, the most advanced war-fighting technology, and the most involved command, control, communications, and intelligence (C3I) networks of the time.[28] In the latter is the subtlety that ended in catastrophe: Darius's military was the paradigm of centralized control and centralized execution. Subcommanders were promoted for their ability to carry out his orders precisely and unquestioningly. Initiative was not a quality that commended one to this career track; the safe path was simply to

follow. So long as Darius was in a position to issue orders, this was hardly a problem; prior to Gaugamela, that position had not been in question. Ensconced in the center of the line with a commanding view of the battlefield, Darius's retinue served as his combined air and space operations center, and his dispatch riders served as his Predator feeds.[29] It typically worked out. Most adversaries were frozen in place simply by the overwhelming presence of the Persian army and then were dismembered in detail by that army's detachments, directed personally by Darius himself.

Alexander, though, was not most adversaries; he didn't follow the script. Outnumbered more than two-to-one, the young Macedonian king was supposed to adopt a defensive formation, cowed by the mere numbers of the Persians along with their cutting-edge war elephants. Instead, Alexander and his Companion Cavalry aim for the center of the Persian formation and charge right for Darius himself. Though facing impossible odds, the Greek horsemen manage to close with the Persian king. Fearing for his life, Darius abandons his mobile command center and flees, and in that moment the brittleness of the Persian army is exposed. Though still technologically and numerically superior, the entire Persian army goes lost link.[30] With the hourglass icon still spinning on the screen, they are destroyed in detail for lack of leaders. With Darius racing off the battlefield, the Persian army shatters; whatever shrapnel remains simply melts away. The same C3I structure that allowed the empire to wield such a mass of forces became a millstone around its neck as a retreat turned into a rout. Persian commanders were trained to follow, not to lead, and without a command link to follow, they simply could not function. Decision making cannot be learned on the fly, and since all the decision makers were weeded out before they made rank, no one was left who could regain control of the situation and rally the Persian army. Thus, a seemingly inferior force shatters the greatest empire of its day and redirects the course of history. The Persia of Darius and Xerxes never recovers.

What should we learn from Darius's downfall? For one, we see that sometimes you get what you ask for. Grab the reins out of the hands of your subordinates too often, and they'll eventually quit fighting you to get them back. After you've told them to shut up and color enough times, they will default to waiting expectantly upon you for precise instruction. Use your strategy cell as a rubber stamp for conclusions you've already reached, and at some point they'll cease to think strategically. An entity as large as his military (or ours) takes a very long time to recycle, and if you run it constantly on "override," it will probably crash when you try to revert to normal operations.

Second, we see that during the building of networks, "What kind?" is at least as important a question as "How much?" It is easy to forget that during the Cold

War, the Soviets were the masters of networking technology. As early as the 1960s, Soviet ships went to sea with "second captain" data links feeding them threats and tracks, all the while recommending doctrinally approved solutions.[31] In much the same way, the Red Air Force's Su-15 interceptor could be controlled through an entire engagement from the ground through weapons launch. Of course, nothing says networking like a Soviet integrated air defense system (IADS).[32] Doubtless, the Soviets had a tremendous amount of connectivity. The problem is that they structured it along distinctively Soviet lines: top-down links for establishing and enforcing adherence to doctrine. Instead of a virtual liaison officer between war fighters, Soviet data links served as digital commissars breathing down the necks of commanders and operators. The fact that Darius would have been proud is fitting because both the Soviet-inspired (though French-built) Iraqi IADS and the Persian army shattered in much the same way. *Never let your connectivity exceed your maturity*. If you can't sit on your hands while watching the Predator feed, you probably shouldn't have access to it.

Lastly, Darius lost perspective of why he was there in the first place. Granted, the Persian Empire didn't have "by the people, for the people" in any of its foundational documents; nonetheless, without the people of Persia, there would be no need for a king of Persia or an army of Persia. Soldiers and commanders fill different roles, but their jobs exist for the same purpose—to defend their people. Soldiers are not there for their commander; they are there to perform the mission, and the commander simply enables them to do so. Perhaps if Darius had remembered this, he would have built his command links accordingly. Rather than emphasizing rigid control, perhaps he could have built organic networks around shared situational awareness (SA). Then, perhaps, his whole military wouldn't have become one big blue screen of death when he was taken out of the picture. When Darius decided that he was more important than the mission, he ensured that the mission couldn't succeed without him—and, of course, it didn't.

What, then, should we incentivize? First, we should use personnel policies to develop individual initiative and, second, networking technologies to build shared SA. Let's start with networking technologies. The ever-present risk of increased connectivity is the migration of tactical decision making farther and farther up the chain of command. The live feed gives senior commanders the illusory perception of actually being present on the battlefield, which in turn brings them into competition with their subordinates in the actual battlespace. Unfortunately, the battlefield tactical commanders lose that competition, and unless the senior leader practices judicious restraint, they end up undermining the command of their subordinates. For those tactical commanders, an induced dissonance now exists between responsibility and authority. On the one hand, they are still held account-

able for whatever happens as a result of their decisions; on the other, they receive those decisions by dictate (or at least by pressure) from staff officers interloping in their battlespace.

Fortunately for us, there is a simple countermeasure to this problem; even more fortunately, it comes right out of our doctrine: centralized control, decentralized execution. Here's a very simple networking application of that principle: "resolution is inversely proportional to field of view." If you want to watch the all-Iraq feed, you don't get to watch the really cool hit going down on a building in grid-square X. If you're watching that hit go down, you don't get to look at everything else in-theater too. Horizontal shared SA is a nearly unmitigated asset. Tactical-level US Air Force operators must be able to access relevant data from tactical-level joint operators in real time. Vertical shared SA is a bit trickier. If a peer-level US Army commander tells you how to fly Army aircraft, it is relatively straightforward to respond in a respectful, cordial manner that preferably includes only a few swear words. If your commander's commander's commander tells you how to fly your aircraft, it is far more difficult to respond in a way that retains your initiative without ending your career. Accordingly, doctrinal provisions must defend our operators' initiative against undue interference. Therefore, just as successful commanders have done for thousands of years, we must return to the wisdom of General Patton's memorable words: "Don't tell people how to do things; tell them what to do and let them surprise you with their results." One corollary: *horizontal networking is almost always beneficial; vertical networking can easily become toxic.*

Regarding the initiative issue, you get the organization you incentivize. What are we incentivizing? To answer this question, we turn to a very abbreviated version of game theory. You can quantify the consequences of most choices into relatively objective outcomes. Once you do so, you can generally predict what choices will be made with what frequency. Let's hypothesize a game called "Getting Promoted." For the sake of our game, we'll say there are only three ways a choice can theoretically turn out—fantastically successful, status quo, or utter failure. Take as a given that making a choice involves a 50 percent chance of success, a 25 percent chance of achieving status quo, and a 25 percent chance of failure (repeating, of course.) On the other hand, not making a choice has a 100 percent chance of maintaining status quo. If you value success, then you're going to promote your decision makers since they give you an even-money shot at it while your status quo bureaucrat guarantees that you'll never see successful change.

However, we measure performance by way of performance reports. Say, entirely hypothetically, that those reports are inflated to such a degree that status quo looks like fantastic success. Fantastic success already looks like fantastic suc-

cess, so it can't really be further inflated; abject failure might be sweetened to status quo, but most likely it will still look like failure. Now, with our perception mitigated by the performance report, let's take a look at our decision makers and our bureaucrats. The decision makers have a 75 percent chance of attaining either success or status quo, both of which now look like fantastic success and make them look like heroes. Unfortunately, they have a 25 percent chance of looking like failures because an actual decision involves risk and can fail. On the other hand, the bureaucrats' 100 percent chance at status quo now makes them look like superheroes, and since they didn't make a decision, they have a zero percent chance of looking like failures. It's 75 percent versus 100 percent, so the bureaucrats win. Here's the bottom line: unrealistic performance reports discourage risk taking and hence decision making.

The problem is that if some commanders rank their people realistically without an entire system overhaul, then they will ensure that their people never get promoted. Instead, those brought up under grade inflators will take their place, further exacerbating the problem. One possible solution may be Harvard Business School's bidding system for competitive classes: commanders have a given number of points to allocate to their troops although they can trade points with other commanders between rating cycles if they happen to have a particularly good or bad crop of troops that term. I'm sure that better answers are out there, but the reality is that until we find a way to associate scarcity with performance reports, we will continue to discourage decision making.

If You Never Take No for an Answer, Then Your Advice Will Come Exclusively from Yes-Men

If you look at the bulk of military disasters, you'll find a cadre of wise counselors (if they haven't all been fired yet) shouting no at the top of their lungs prior to the point when the commander made the decision to press. Like performing a safety investigation on a mishap, the historical flight recorders tell of Cicero shouting, "This is stupid!" at Marcus Crassus prior to the calamitous battle of Carrhae. Unfortunately for Crassus, and for those under his command, ancient Rome didn't have a two-challenge rule.[33] The tape ends with the sound of Parthian mounted archers slaughtering the entire Roman force. I cannot imagine that the patent foolishness of Napoleon's invasion of Russia or the similarly stupid and similarly unsuccessful Operation Barbarossa escaped the notice of their entire respective general staff. That said, given Stalin's and Hitler's treatment of dissent, it is unsurprising that their staffs kept their mouths shut.

Some moves are strategic gambles, but others are just plain stupid. Generally in the latter case, your troops know it (especially your senior noncommissioned

officers). The common-sense-override button doesn't work so well when you know you're the one who's going to have to pay the price. Custer provoking a battle at Little Bighorn despite being isolated and vastly outnumbered—not smart. Marching across a mile of open field into the center of the fortified Union line—not smart. Sacking an army of bored and hungry adolescents with no job skills other than using a Kalashnikov in an as-yet unsecured country—not smart. This isn't rocket science—you don't need better graphs and multiple regressions and analysts to figure these things out. You just need the humility to listen to your people and the maturity to admit when they're right.

As a corollary, our techno-centric military has an understandable soft spot for engineers. Unfortunately, this sometimes brings operators to loggerheads with those same engineers. When an operator says, "This just doesn't make sense," he or she should be taken seriously. The distance between the acquisitions community and the operators must be reduced, and priority must be given to the needs of those on the tip of the spear, not to the desires of the contractors or the whims of the program office. Consider the tremendously successful A-1 Skyraider and the AC-47 Spooky. These stubborn, operator-centric aircraft were hardly on the cutting edge of aeronautical technology, but they were exceedingly good at what they did. On the other hand, the cutting-edge F-105 makes a fine display at the Air and Space Museum but was woefully inadequate against obsolescent MiG-17s in actual war.[34] Notably, the first person to satisfactorily explain why (specific excess energy and energy-maneuvering theory) was not some PhD of aeronautical engineering but the fighter pilot John Boyd. Further, Boyd's lightweight fighter (the F-16) revolutionized dogfighting with ultrapractical "hands on throttle and stick" technology, which was really nothing more than putting all the buttons in the right places.[35] Operator's intuition should never be discounted in the name of theory because the little practical things add up and make the difference in war.

Concluding the yes-men point, we note that another fighter pilot provides the perfect antidote—the "red cell." Create a group whose sole job is to provide exceedingly well-thought-out "nos," and when they run out of them, you know you have a good strategy. John Warden presided over just such an organization, and the results speak for themselves. By applying the principles that would later be articulated in Warden's book *The Air Campaign*, Lt Gen Charles Horner was able to systematically and strategically dismember Iraq.[36]

It all goes back to Sun Tzu—know your enemy and know yourself. We were better than the Russians at knowing the Russians, at least on some levels, so we beat them. Have we become better than al-Qaeda at understanding al-Qaeda? Are we better at using soft power than are potential near-peer competitors? Until we can beat them at their own game in our war games, we will continue to strug-

gle to defeat them strategically. We must shepherd and safeguard the resource of our strategists: we must go to them with questions, not with answers. When we can answer all of their questions, then we'll have a strategy worth having.

If You Promote People for Trivial Things, You'll Make a Force Obsessed with Trivialities

If decadence is the sign of a nation in decline, then a lack of seriousness about war fighting is the bellwether of a foundering military. The historical examples of this are both legion and tragic. Squabbling over petty rivalries with the enemies at the gates, Kiev finds itself unable to mount a defense against the Golden Horde of the Great Khan. The citizens of the city bear the brunt of their defenders' failure, slaughtered wholesale as a lesson to any would-be resisters. In the same vein, changing the uniform of the defenders of Rome did little to stop the winged-helmet-wearing invaders, but at least the imperial armies died well dressed. The armies of the White Russians, their leaders obsessed with title, privilege, and proper schooling, were picked apart piecemeal by the forces of the Reds in a war that could have been won. Their defeat inaugurated a century of their country-men's self-inflicted slavery to a soulless machine government and the rise of one of the bloodiest regimes the world has ever known. You cannot expect to prevail over your enemies on the battlefield if the mission doesn't prevail over trivia in your planning.

I remember a very experienced colonel from my old squadron, a "last of the breed" kind of guy who somehow survived the bureaucratic personnel machine. He recalls being counseled regarding his promotion recommendation form for major. "All I see here is a lot of combat time," his senior rater commented. "Isn't that what we're here to do?" he replied. A military exists to fight and win wars. We are not some corporation, forever churning out widgets to maximize shareholder profits and finance executive salaries. We are our nation's insurance policy, and the deductible for that policy is paid in our blood. Being able to deliver on that policy is primary. Everything else is secondary.

We highlight certain actions as worthy of emulations through costly signals such as recognition, decoration, and promotion. What messages, and are they consistent? Do these messages highlight performance and duty or reinforce ex-tant power structures and "approved solution" career paths? Do we reinforce the fierce urgency of combat, in all of its technologically mediated forms, or do we accede to the stale demands of those whose cultural capital is built upon the status quo and cannot see a world beyond it, no matter what that world might bring to the fight? Our institutional messaging must obsess with simple combat effective-ness because that and that alone will accomplish our nation's missions at the least

cost of blood and treasure. Sentimental nostalgia for a war gone by and bureaucratic "administrivia" both have the same root—avoiding the tough work of change, and doing so slows us down in fighting this war and preparing for the next. We are measured by our ability to protect and defend the Constitution from all enemies, foreign and domestic—and nothing else.

None of this is to discount the importance of force development, and certainly promotions are based on your ability to act in the next grade rather than performance in your current grade. That said, performance in your present grade is a pretty good predictor of performance in the next grade. Professional military education is critically important, but *education* is the key word here. It is a bad omen indeed when our fast burners haven't heard of Belisarius but are quite fluent on the gamesmanship of the various wing-level measures of organizational effectiveness. The key here is returning to a mission focus—our mission is war fighting, and we need to determine the difference between arbitrary administrative gamesmanship and true education of professional warriors. All of our actions need be intimately tied to winning the war we're in, preparing for the next war, and deterring the wars that we can't afford to fight.

This may seem heavily biased toward operations, but I would contend that it is instead heavily biased toward missions—and appropriately so. The mission is the priority, and it's not about who is on the tip of the spear but about how sharp we keep the spear together. That said, logisticians have proved the decisive factor in countless campaigns. I am certain that you cannot win a war without food services, and I am positive that you cannot win a contemporary war without public affairs troops. (In the words of T. E. Lawrence, the printing press is the most effective weapon in the arsenal of the modern commander.) "Who is on the pointy end of the spear?" is not the most useful question because this war and its successors have many fronts, and all of us will at one time or another find ourselves at the pointy end of one of those fights. The better question is, "What is my war, and how can I fight it better?" In this way, a maintenance troop fights a war by holding back the friction of war with his tool kit and denying the enemy mission kills due to broken aircraft. A public affairs officer counters al-Qaeda's strategic communication-warfare campaign, ensuring that when high-value-target no. 314 goes down, he stays down. An acquisitions officer fights our future wars by making sure that we get every platform we possibly can from our shrinking pool of resources—and so on.

Rather than leave on a note of gloom and doom, permit me to conclude with one more one-liner: *it's not inevitable until it actually happens*. Here's the funny thing about the word *inevitable*: people generally use it only after the fact, as in, "It's nobody's fault because it was inevitable" or "Nobody could have changed it

anyway." Of course, this is not true; history is full of men and women who thwart the seemingly inevitable. Declines have become golden ages; renaissance is born in times of crisis and change. The difference between a decline and a renaissance is the willingness to address the deeper issues creating crisis. Until you can address the bedrock issues creating your problems, you're just changing flap settings on a crashing jet. By addressing those issues with wisdom and courage, you can reignite the vigor and renew the fire of your people. If world history is a teacher, we'll need that fire. As the old SEAL saying goes, "The only easy day was yesterday." This may very well be true for our country. We need to be ready.

So what's the answer? How, then, should we fight? Well, that answer is not in this article—I promise. If I might hazard a guess, I would say that the one big answer we need is really a summation of a bunch of common-sense small answers. I would be willing to wager that the three-striper turning wrenches on the flight line has one of those answers. I would also bet that the captain working in the intelligence shop has another one of those answers. And the tanker navigator. And the Viper driver. And the public affairs officer. And the Pave Hawk gunner. If this Predator-and-gunship guy might add one more common-sense small answer, however, I would point out that three things pretty much script everything else: how you spend money, how you promote people, and how you structure yourself. If you fix these three things, then everything else will fix itself in time. Fortunately, time is something we have—at least for the time being.

Notes

1. Will Durant, *The Story of Civilization*, vol. 3, *Caesar and Christ* (New York: Simon and Schuster, 1944).

2. Col Qiao Liang and Col Wang Xiangsui, *Unrestricted Warfare* (Beijing: PLA Literature and Arts Publishing House, February 1999) (text translated by Foreign Broadcast Information Service), http://www.terrorism.com/documents/unrestricted.pdf.

3. Ibid.

4. Surface-to-air missiles are the Soviets' preferred counterair weapons system.

5. A forward operating base is "an airfield used to support tactical operations without establishing full support facilities." Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 8 November 2010 (amended through 16 July 2014), 102, http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf.

6. John R. Boyd, "Destruction and Creation," 3 September 1976, http://www.goalsys.com/books/documents/DESTRUCTION_AND_CREATION.pdf.

7. Robert Coram, *Boyd: The Fighter Pilot Who Changed the Art of War* (New York: Little, Brown, 2002), 169–87.

8. The OODA loop is a dynamic model of adaptation that Boyd used to describe everything from dogfights to long-cycle strategy. More precisely, he employed James Clerk Maxwell's concept of motion perpendicular to the plane of oscillation to describe adaptation, which is the same principle used in a reciprocating engine, where the resultant force is expressed perpendicular to the pistons. Boyd, "Destruction and Creation," 1–8.

9. The *condottieri* were Italian mercenaries of the fifteenth century. Renowned for their skill in battle, at least initially, these mercenary armies displaced the professional armies of the Italian city-states. Since they were primarily employed in intramural wars against each other, when they did meet in combat, they wore excessive amounts of armor and deemed battles concluded after very few casualties (when they didn't just conclude them beforehand with bribes). Consequently, when they met the French national army of Charles VIII, they were soundly defeated. See Michael Mallett, *Mercenaries and Their Masters: Warfare in Renaissance Italy* (Totowa, NJ: Rowman and Littlefield, [1974]).

10. Zero Defects, Total Quality Management, and Six Sigma are all management philosophies oriented largely toward engineering the errors out of systems. Zero Defects, the brainchild of Phil Crosby, dates back to the space program. (Note that the space program's challenges were ones of mathematical precision, not Clausewitzian chaos and an enemy's cunning.) Total Quality Management, of Toyota fame, was primarily an adaptation of Japanese organizational principles. Six Sigma, the latest incarnation of the philosophy, applies advanced statistics and quantification techniques toward the same goal of reducing deviation from a set standard.

11. The weapon engagement zone is a dynamic launch area that yields a favorable probability of kill against a target fitting specified parameters. A shot from the "heart of the zone" gives you the best chance, all else being equal, of hitting your target.

12. The probability of kill is a statistical measure of the likelihood that a given weapon will destroy its target.

13. Clark G. Reynolds, *Admiral John H. Towers: The Struggle for Naval Air Supremacy* (Annapolis, MD: US Naval Institute Press, 1991), 238.

14. The built-in-test feature allows a given piece of avionics to assess and report its own system health.

15. Strategic Air Command was the US Air Force's deterrence-centric Cold War heavyweight command.

16. Checkmate is an Air Force strategy cell, most famous for John Warden and David Deptula's Instant Thunder war plan during operations Desert Shield and Desert Storm.

17. The Strategic Defense Initiative, more commonly known as "Star Wars," was a planned, layered defense against nuclear missiles. The program sparked an arms race that helped bankrupt the Soviet Union.

18. Operational risk management is a system for assessing and mitigating risk through analysis and controls.

19. During the Anglo-Russian Great Game for Central Asia, Russian generals made their names by conquering the cities of Bukhara, Khiva, Merv, Kokand, and Tashkent. Later, the territory would be divided into the territories that are today Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Turkmenistan. See Peter Hopkirk, *The Great Game: The Struggle for Empire in Central Asia* (New York: Kodansha International, 1992).

20. *Mission creep* describes the increase of objectives without a concomitant increase in capabilities.

21. Base realignment and closure (BRAC) is a process meant to bring fairness and efficiency to the Department of Defense's basing decisions. BRAC recommendations must be confirmed by the president and Congress, but once they do so, BRAC decisions become law. News of a closed base is typically received poorly by local communities, and well-connected ones have been known to reverse BRAC decisions through political maneuvering.

22. On a similar note, consider the disconnect between our acquisitions processes and Moore's Law, which basically states that the doubling time on technology is about two years. In a globalized information economy, even civilian intellectual property rights are difficult to enforce, much less eagerly-sought-out defense technologies. Agility is the new information security: the only way to preserve your technological edge is to turn innovations into combat-ready designs faster than your adversary can. With decade-long Byzantine acquisitions pathways, we end up merely subsidizing everyone else's research and development.

23. For the Five Rings strategy, see John A. Warden III, *The Air Campaign: Planning for Combat*, rev. ed. (San Jose: toExcel, 1998).

24. See David A. Mindell, *Iron Coffin: War, Technology, and Experience aboard the USS Monitor*, updated ed. (Baltimore: Johns Hopkins University Press, 2012).

25. F-86 Sabre jets enjoyed a reported eight-to-one kill ratio against their nemeses, the MiG-15s. Kenneth P. Werrell, review of *Sabres over MiG Alley: The F-86 and the Battle for Air Superiority in Korea*, by Stephen Budiansky, *Journal of Military History* 70, no. 4 (October 2006): 1104–5.

26. "Duty, Honor, Country. Those three hallowed words reverently dictate what you ought to be, what you can be, what you will be." Douglas MacArthur.

27. Operation Barbarossa was the code name for Nazi Germany's invasion of Russia in 1941.

28. *C3I* is a common term for the implements of effective centralized command.

29. The combined air and space operations center is the senior operational C3I element of an air campaign.

30. "Lost link" is a flight profile for a remotely piloted aircraft. Having lost command link, the aircraft leaves its primary mission to return home and seek new instructions.

31. Norman Friedman, *The Naval Institute Guide to World Naval Weapons Systems, 1997–1998* (Annapolis: MD: US Naval Institute Press, 1997), 97–98.

32. An IADS is a layered defense of surface-to-air missiles, antiaircraft artillery, and airborne interceptors, designed to prevent incursions from hostile aircraft.

33. In crew resource management, the two-challenge rule sets forth a guideline that upon noticing a potentially dangerous situation, the pilot not flying states the nature of the situation and challenges the flying pilot to address it. After doing so twice, if there is no response, that pilot is empowered to take the controls and resolve the situation himself or herself. Similarly, "this is stupid" is a key clause for breaking an error chain and should direct the aircraft commander to reassess the situation.

34. The Thud (F-105 Thunderchief) was known for performing poorly against older MiGs in dogfights over Vietnam. It had a tendency to bleed energy rapidly in turns, allowing the more agile MiGs to engage at guns range whereas the MiG's heavier cannon armament outclassed that of the F-105. Energy-maneuvering theory, developed by Boyd, was the first effective mathematical means of quantifying the pilot's intuitive preference for agility, and explained this mismatch perfectly. Coram, *Boyd*, 123–53.

35. "Hands on throttle and stick" is an ergonomic principle used to optimize the F-16's pilot-aircraft interface.

36. Warden, *Air Campaign*.