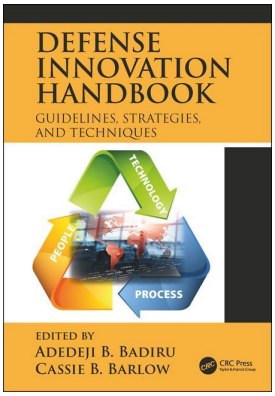

Defense Innovation Handbook
Guidelines, Strategies, and Techniques

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Strategy and military technology

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chapter seventeen

Strategy and military technology

The three offsets

Bud Baker

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A case study in deterrence: The Strategic Air Command

The longstanding motto of the Strategic Air Command—"Peace is our Profession"—was often seen by critics as irony: "Yeah, war is just a hobby." But for those who served in that organization during the Cold War, there was no contradiction at all: In a nuclear world, where the two major adversaries had tens of thousands of nuclear warheads aimed at each other, the term "victory" had little meaning: To fight would be to lose. Thus came the strategy of nuclear deterrence, a preventative approach mirroring the wisdom of Sun Tzu in the *Art of War*: "The supreme art of war is to subdue the enemy without fighting."

The relationship between defense strategy and military technology leads to some principles that will underlie the remainder of this chapter, and those principles need to be acknowledged explicitly. First, military technology is constantly evolving, and that evolution is not random: Much technological innovation is built upon earlier technology breakthroughs, which themselves were designed to *counter* technological advances by a real or potential adversary. This is, of course, an endless cycle, and ensures that there is never an "ultimate weapon." So, to use an ancient example, bands of medieval marauders drove the creation of fortified towns, which in turn led to better siege engines, which in their turn produced even more elaborate fortifications, with their round towers, crenellations, moats, and drawbridges. Those defenses then led to the proliferation of high explosives, and so on. There is, to date, no apparent end to this pattern, no "weapon to end all weapons."

Another principle: Military technology need not be—indeed generally *is* not—symmetric in nature. That is, people will fight with whatever tools are available to them,

and technological sophistication is not necessarily part of the mix. While in some cases technological innovation *can* move in parallel among potential combatants—consider the roughly similar triad of strategic nuclear forces maintained by the US and USSR/Russia since 1950—in many cases the opposite occurs: Opposing forces in the same conflict may operate from vastly different technological playbooks: Consider contemporary struggles, where one side relies on the technologically simple—airplanes flown into buildings, for example, or suicide bombings—while the other side relies on technologically sophisticated techniques like unmanned air vehicles, precision bombing, stealth technology, or cyberwarfare.

A third characteristic of modern military technology is the reality of ever-shortening product life cycles. Compare, for example, the Industrial Revolution, which played out over the better part of a century, to the rapidity of today's information revolution, in which giants like Google and Facebook are barely out of adolescence. Capabilities change rapidly in today's world, and anyone intending to counter those capabilities must be at least as agile. Even weapons technology that might seem on the surface to be relatively basic must be adapted and redeployed in a very short time: Consider, for example, the use of Improvised Explosive Devices (IEDs). American forces in Iraq learned that countermeasures that worked against an IED one day might be utterly ineffective against the next generation, just months—or even weeks, or days—later. If lethal weapons can change that fast, the associated countermeasures must be equally adaptive. Thus in 2006, the Joint Improvised Explosive Device Defeat Organization—JIEDDO—was established, to slash the countermeasure development response time from what was typically years to months, even weeks (Defense Threat Reduction Agency, (2016)).

So to summarize, military uses of technology can be offensive, defensive, or preventative. Such technologies are constantly evolving: They never stand still. Technologies need not be symmetrical: Adversaries may have different technological philosophies, based on distinctive competence, historical experience, or doctrinal tenets, which can be expected to drive variations in their technological investment. And whatever technologies are employed, the clear trend is toward ever more rapid change, driving a corresponding need for faster adaptation.

American defense strategies

Technology development as a core belief

For most of the last century, the American military has put technology at the forefront of military planning. There are many reasons for this, not all of them obvious. Nowhere is this focus on technology more obvious than in the development of what became the United States Air Force.

> The men in charge of the future Air Forces should always remember that problems never have final or universal solutions, and only a constant inquisitive attitude toward science and a ceaseless and swift adaptation to new developments can maintain the security of this nation through world air supremacy.
>
> **—Theodore von Karman, 1945 (as cited in Daso, 1997)**

But it wasn't always so. The pioneering years of the US Army Air Service were marked by mere halting steps in technological development, as the United States lagged behind

the nations of Europe. Of all the factors that led to the defeat of Germany in World War I, American aviation technology was clearly *not* one of them:

> …by the time the Armistice came, we did have 2,768 completely trained pilots and observers on the Western Front. Out of 20,000 officers and 149,000 enlisted men of the Army Air Service at home and abroad, almost 40 percent of the officers and 50 percent of the enlisted men were in France or at advanced training bases in England. Many more would have been there if there were airplanes for them……*No American-designed combat planes flew in France or Italy during the entire war* (Italics added) (Arnold, 1949).

The author of those words, General Hap Arnold, went on to lead the US Army Air Forces from 1938 to 1946, and his enormous influence on aviation technology was felt for an even longer period than that. The only person ever designated as a 5-star "General of the Air Force," General Arnold devoted deep thought to the relationship between military forces and the larger society to which they belonged, and he came to believe that democracies would never be able to match up numerically with the armed forces of totalitarian states. To General Arnold, this insight meant that American Air Forces would always need to rely on technological advances, rather than superiority in numbers. And he understood that those technology breakthroughs were not likely to come solely from within the Air Corps, but also from partners in academia, science, engineering, and business. As he explained in a speech, shortly before he became US Army Air Corps Chief:

> Remember that the seed comes first: if you are to reap a harvest of aeronautical development, you must plant the seed called experimental research. Install aeronautical branches in your universities; encourage your young men to take up aeronautical engineering… Spend all the funds you can possibly make available on experimentation and research. Next, do not visualize aviation merely as a collection of airplanes. It is broad and far-reaching. It combines manufacture, schools, transportation, airdrome building and management, air munitions and armaments, metallurgy, mills and mines, finance and banking, and finally, public security—national defense (Daso, 1997).

Always a realist, General Arnold believed that his Air Force would not be able to attract or retain sufficient numbers of high quality scientists and technologists. For that reason, he stressed technology partnerships as an essential part of planning for future airpower capabilities. He reached out to an unprecedented consortium of strategic thinkers at leading universities, as well as to inventors, aviators, aeronautical designers, automotive manufacturers, and financiers. Through the National Academy of Sciences, he held meetings of top technology experts, gatherings which sometimes raised eyebrows in the more traditional senior officer ranks:

> Few high-ranking Army officers seemed aware of the close relationship developing between these specialists and the little Air Corps—a relationship that was to grow to such importance in World War II that civilian scientists would work side-by-side with staff officers in

> our overseas operational commands, frequently flying on combat missions to increase their data.
>
> Once, after George Marshall became Chief of Staff, I asked him to come to lunch with a group of these men. He was amazed that I knew them. "What on earth are you doing with people like that!" he exclaimed.
>
> "Using them," I replied. "Using their brains to help us develop gadgets and devices for our airplanes—gadgets and devices that are far too difficult for the Air Force engineers to develop themselves." (Arnold, 1949)

General Arnold commissioned the Army Air Force's Scientific Advisory Group (SAG, today known as the Scientific Advisory Board) in 1944, to advise him and to guide the technological strategies of the USAAF. Led by General Arnold's trusted colleague and advisor Theodore von Karman, the SAG provided the foundation and blueprint for General Arnold's vision of Air Force technological supremacy. Its prescient 1945 report *Toward New Horizons* foresaw many of the scientific developments which would come to fruition over the next seven decades, and which are taken for granted today.

While farsighted thinkers like General Arnold were focusing on technology, military and political leaders elsewhere were relying on numbers: More planes. More tanks. Bigger armies. The struggle between those competing views—in a sense, the question of quantity vs. quality—is central to the three Offset strategies discussed in the coming pages.

The three offsets

The first offset strategy

Recall that one of our opening principles held that defense strategy need not be symmetrical. Grasping this idea is essential to understanding of what has since become known as the First Offset Strategy.

Various definitions of offset strategy exist: One arguably too-simple definition is "a technological response to a perceived military weakness" (Korb & Evans, 2017). Sadler (2016) offer a more specific and nuanced definition, one which more fully captures the technocentric essence of the "offset" concept: "An offset seeks to leverage emerging and disruptive technologies in innovative ways in order to prevail in Great Power competition."

The Soviet Union had tested its first atomic bomb in 1949, and its first hydrogen bomb just four years later. At that point, the USSR embarked on a major effort to build an offensive nuclear force, intending to match and indeed surpass the power of the US Air Force's nascent Strategic Air Command. The Soviets launched their first ballistic missile in 1947 (Federation of American Scientists 2000), and by 1950, according to some sources, Soviet military spending exceeded that of the United States. The Soviet Long Range Aviation arm received similar attention, with well over two thousand long range bombers developed and built beginning in the early 1950s, a number that was far beyond anything US air defenses could be expected to intercept.

At this point the administration of US President Dwight D. Eisenhower faced a strategic decision: They could continue to invest in large numbers of manpower-intensive conventional forces, aimed at fighting and winning conventional wars—like the Korean Conflict just then winding down. This idea was found to be unappealing in several ways. Most obvious was the enormous and unsustainable expense that would be involved.

President Eisenhower clearly believed that the USSR's massive forces were intended to force the US and its Western allies into a self-destructive and untenable spending surge. In a radio address to the American people just months after taking office, the new President explained:

> We must see, clearly and steadily, just exactly what is the danger before us. It is more than merely a military threat. It has been coldly calculated by the Soviet leaders, for by their military threat they have hoped to force upon America and the free world an unbearable security burden leading to economic disaster (Eisenhower, 1953).

There was another technological dimension that was just beginning to be understood, and that was the transformation created by nuclear weapons, which had been first employed just eight years before. Until Hiroshima and Nagasaki, wars were fought with the general understanding that one side would win, and the other would lose. But nuclear weapons changed all that: Both the size and the power of nuclear arsenals had forever altered the meaning of "winning": By 1953, it was dawning on decision makers that to even *fight* a nuclear war was to lose. Even if a country's defenses were *perfect*—a state that had never come close to being attained in any military confrontation—just the nuclear fallout from one's *own* attacks would likely bathe the earth in radioactive poisons for months, or longer.

What resulted from all this was what is known today as the First Offset Strategy. At the time it was called the "New Look," and it was classically adaptive in nature: It was designed to meet an offensive threat not with an appropriate *defense*, but with a countervailing *offense*. With the "New Look," American defense dollars were diverted from conventional defensive systems—especially land- and sea-based—to fund an enormous buildup of US offensive nuclear forces—the Strategic Air Command's thousands of manned bombers, and the creation of intercontinental and submarine-launched ballistic missile forces. The foremost aim of these forces was not to *fight* a nuclear war, but to *deter* one. The era of Nuclear Deterrence and "Massive Retaliation" had begun.

Deterrence, then, was not so much a choice between alternatives as it was a decision by default: There really *was* no alternative. Some called it a strategy of "Massive Retaliation," while others referred to it as "Mutual Assured Destruction." In the words of General Curtis E. LeMay, Commander-in-Chief of the Strategic Air Command (SAC) and later Air Force Chief of Staff, those terms were not apt:

> Massive retaliation was a term coined by either newspapermen or some public affairs guy someplace in the military. The idea was to have overwhelming strength so that nobody would dare attack us—at least that was my idea of it, and what I attempted to accomplish out at SAC—that we would have such strength that we would never have to do any fighting (Kohn & Harahan, 1988).

That objective cited by General LeMay—"that we would have such strength that we would never have to do any fighting"—proved elusive, of course. While nuclear deterrence proved an effective strategy for averting global war, its many shortcomings came to be well known. For one thing, nuclear deterrence strategy—the central tenet of the First Offset Strategy—did little to prevent lower-intensity conventional wars around the world, like the Vietnam Conflict or Arab-Israeli confrontations in the Middle East.

The second offset strategy

By the mid-1970s, a generation after the First Offset, history looked to be repeating itself. Just as after Korea, another Asian conflict had wound down, in Vietnam, and defense budgets were again falling. The end of the military draft in the US meant that the increased expense of military manpower—in the form of the "All Volunteer Force"—would put increased economic pressure on Department of Defense budgets. In Europe, the US and its NATO allies were facing Soviet and Warsaw Pact forces that outnumbered them by a factor of three-to-one. War games and simulations featuring a Warsaw Pact thrust through the Fulda Gap into West Germany predicted defeat for NATO Forces.

Meanwhile, in the Middle East, the Yom Kippur War in October 1973 had been short—just eighteen days from start to finish—but exceptionally costly to the Israeli military: Even with Israel's superbly trained aircrews flying the most modern western aircraft, the Soviet-provided air defenses exacted a huge price, downing over a hundred Israeli combat aircraft, about half of them in just the first three days of the war (Israel Defense Forces, (n.d.). (1973)).

Facing these military and economic challenges, President Carter's Secretary of Defense, Harold Brown, and his Undersecretary of Defense for Research and Engineering, William J. Perry, developed what became known as the Second Offset. Dr. Perry, its primary architect, identified areas in which American technological prowess could provide a significant competitive advantage. Consulting with the Defense Advanced Research Projects Agency (DARPA), he based the Second Offset on three emerging technologies: Battlefield awareness, through enhanced intelligence, surveillance, and reconnaissance; precision-guided munitions, and low-observables—stealth—technology (Perry, 2003).

In light of the technological successes of the Second Offset's weapon systems, the logic behind the Second Offset seems unassailable. But it was not that way at the time. Opponents like the Congressional Reform Caucus believed that the heavy reliance on technology was wrong-headed and unaffordable; Rather than smaller numbers of high technology weapons, the "defense reformers" argued that the real need was for large numbers of simple, low technology systems: As Secretary Perry saw it:

> The Caucus's view was that the offset strategy was a terrible idea, and what we ought to do instead was to focus on competing with the Soviets in numbers, setting aside the question of how we could persuade the public to support an army two or three times the existing size. They argued that the technology was a step backward and would introduce a complexity in weapon systems that the military personnel would be unable to operate or maintain. They didn't say it in so many words, but they implied that the military personnel were not capable. Instead, they would say things like, "It would take a Ph. D. to operate the equipment." I thought they were profoundly wrong (Goldberg & Trask, 1998).

The third offset strategy

In a November 15, 2014 memo in which he cited "eroding" American military dominance, Defense Secretary Chuck Hagel introduced his "Defense Innovation Initiative." The memo itself is oddly vague, but lurking on the second page, in lower-case letters, were the words "third offset strategy." Yet while the "offset" terminology was downplayed in the memo, the connection to the past offset strategies was clear (Hagel, 2014a).

Secretary Hagel made that connection even more clearly in a Reagan National Defense Forum speech that same night. He also outlined the specific technologies that he saw as the focus of the Third Offset, echoing the long-ago ideas of Hap Arnold, as he called for closer collaboration between the Pentagon and civilian technology experts:

> Our technology effort will establish a new Long-Range Research and Development Planning Program that will help identify, develop, and field breakthroughs in the most cutting-edge technologies and systems—especially from the fields of robotics, autonomous systems, miniaturization, big data, and advanced manufacturing, including 3D printing. This program will look toward the next decade and beyond.
>
> In the near-term, it will invite some of the brightest minds from inside and outside government to start with a clean sheet of paper, and assess what technologies and systems DoD ought to develop over the next three to five years and beyond (Hagel, 2014b).

Just as Secretary Perry had found thirty years previously, Secretary Hagel's Third Offset was met with both cautious cheers and caustic complaints. One critic called The Third Offset "fairy dust," and likened it to hitting the "Easy" button, *a la* the popular television commercials from Staples office supply. The same critic added that "basing a strategy on technological innovation that is not in hand is nothing more than wishful thinking" (Carafano, 2014).

Of course, that same critique could have been made about the Second Offset—stealth technology, precision guided munitions, and the other Second Offset innovations—which have now stood the test of time—and of combat operations—for three decades.

And next?

We saw at the beginning of this chapter some truths about the development of military technology, and the strategies related to it: It is often asymmetric, the rate of change is high and even increasing, and the cycle of weapon-and-counterweapon never ends. Considering Secretary Hagel's 2014 announcement of the Third Offset strategy, what are likely to be the impacts of the 2016 presidential election, and the resulting changes in the nation's political power structure?

Opinions abound, but all acknowledge the perilous situation facing any program when a new administration comes to town. Observers suggest that three options generally exist, for Third Offset or any similar initiative: Abandonment, neglect, or active support, even if that support is given under a different name. Given the present political atmosphere in Washington, the third option seems the least likely (Pomerleau, 2017).

Other defense experts doubt that the name of an initiative matters very much anyway. Much more important, they argue, is that the underlying ideas are recognized, understood, and supported. There is broad agreement on these underlying themes:

- Technology is most useful when focused on specific problems in need of solutions.
- Technology matters, and is an area in which the US has a proven distinctive competence.
- But technology is not the *only* thing that matters: The military must have in place the right workforce and the right processes to capitalize on technology as a competitive advantage.
- Asymmetry must be embraced. The US must look beyond fixing perceived weaknesses, to take advantage of its unique strengths (Johnson, 2016; Hicks, 2017).

Conclusion

Nearly a century has passed since a young Lieutenant Hap Arnold began to see the possibilities of advanced technology, as a means of offsetting an enemy's advantages in military strength. In those decades, General Arnold's ideas have been developed, tested, and refined, and yet his basic observations remain intact. Technology remains a distinctive American competence, and maintaining that technologic superiority will remain a critical challenge for the next century.

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