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THE ROLE OF THE HUMAN OPERATOR IN THE THIRD OFFSET STRATEGY

Adam Biggs and Rees Lee

The Third Offset Strategy has become a common topic of discussion in Department of Defense (DoD) circles. In these debates, people regularly throw around new ideas about research and development (R&D) priorities, as well as about the often-desired deliverables, the shiny new toys—people love widgets they can hold or capabilities they can see in the form of new equipment. But these research initiatives are about more than the technology. Like its predecessors, the Third Offset Strategy is truly about maintaining American military superiority—a critical point sometimes lost amid fascinating debates about artificial intelligence (AI) and swarms of learning machines on the battlefield. Specifically, the Third Offset Strategy is not about securing future battlefield capabilities in the twenty-second or twenty-third century; it is about securing our advantage for the next ten or twenty years. Today's active-duty personnel need to see these benefits for battles they will fight but that have not yet begun.

This defined timeline is not a simple discussion point; it is the linchpin that keeps the conversation focused. Third Offset discussions regularly are given a wide berth when it comes to potential technologies, so a second point becomes critical to maintaining good order and discipline in the debate: that military R&D does not begin or end with the Third Offset Strategy. The initiative is a guidepost that will point to a series of research priorities for the near future. Not all R&D projects will fall under this initiative, nor should we ignore futuristic science that falls completely beyond its current scope. Instead, we can use the Third Offset Strategy to define a series of plausible research priorities to guide resource allocation, funding, and desired deliverables or outcomes. A related consideration is that the goals cannot be research-only deliverables. It is not enough to deliver

a buggy prototype or to push the science forward; these initiatives must yield tangible battlespace advantages for our personnel.

Already we have not started this article in the way that most Third Offset Strategy discussions begin. We did not lead by outlining technology objectives or descriptions of the previous offset strategies—and there are several good reasons why. First, lists of technological objectives split off in many different directions more quickly than a company of young sailors or Marines on their first special liberty. Second, this offset is not actually about the technology. The new gadgets will prove useful, but our focus should be on the human operators—our personnel are the most critical component to continued operational success. Moreover, we have a near-unique opportunity to leap forward in optimizing human performance. Third, the current offset strategy is not like its predecessors. It will become necessary later in this discussion to contrast and compare the different offset strategy examples, but right now—at the onset of this offset—the purpose of discussion must be to establish priorities, tangible deliverables, and a timeline.

- Our priorities are determined by the resources we have and the adversaries we face.
- Our tangible deliverables are determined by the realistic improvements and advancements that are possible within the relevant time frame.
- Our timeline covers the first half of the twenty-first century.

Now we can get started; we can move on to the question that must be answered before the Third Offset can move forward—the multibillion-dollar question: What should our Third Offset Strategy actually be?

ENHANCED HUMAN PERFORMANCE: THE GOAL OF THE THIRD OFFSET STRATEGY

We propose that enhancing human performance should be the ultimate goal of the Third Offset Strategy. To clarify this point: we are not suggesting a minimal or irrelevant role for technology within this agenda; technology will prove just as critical as in the previous offset strategies. Instead we are saying that the technologies developed should provide new operational capabilities or enhancement opportunities for the human operator.

This approach builds on a theme that we will mention again and again, because it should be a critical underlying philosophy of the Third Offset Strategy: let the computers do what they do best, and let the humans do what they do best. Computers are much better than humans at processing raw information, so let the computers crunch the numbers and feed that information to the human operators. However, computers cannot clear rooms or steer ships. Human operators remain the backbone of our operational capabilities, so human performance

remains crucial to our tactical success. Let the computers give better information to our human operators and improve the human operators' capabilities, and the combined effect will be increased operational effectiveness.

Although the human performance element has been the one constant in five thousand years of warfare on this planet, what has changed is the capabilities and opportunities that are emerging or newly available—i.e., just at our fingertips—today. We divide these opportunities into three overlapping areas: (1) cyber initiatives, (2) human-machine integration, and (3) precision selection/training.

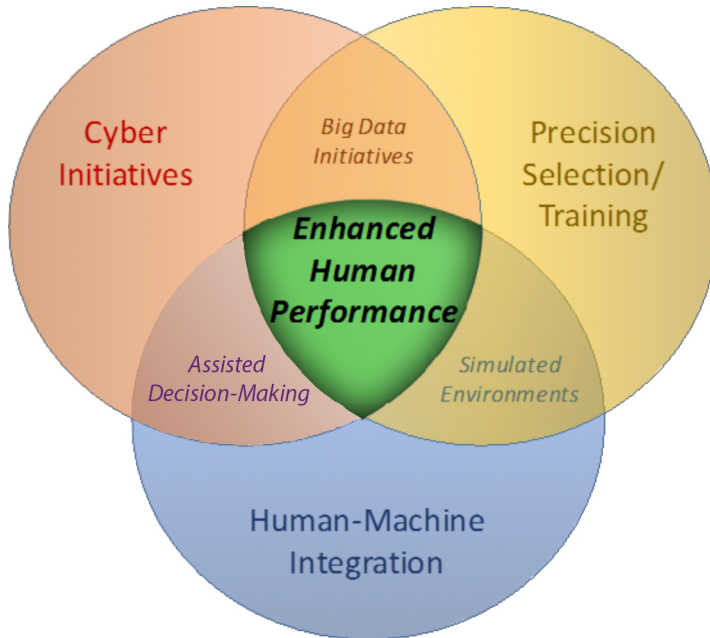
We suggest—somewhat counterintuitively—that consideration of cyber initiatives, although they represent the most technological thrust of the Third Offset, can remain within the scope of human performance considerations. These aspects remain amenable to the theme of “let the computers do what they do best.” The various initiatives can create better information-processing systems so the most useful, most accurate, and most reliable information is delivered to the human operator who makes the critical decision.

Human-machine teaming represents a subject often considered within the scope of Third Offset Strategy projects. This category involves a wide array of opportunities to enhance human performance by integrating machine products and programs directly into critical tasks. For example, augmented-reality (AR) systems can improve performance by delivering updated information directly into a heads-up display (HUD). We now have the ability to integrate humans and machines in complex ways that result in true interdependence and yield superior performance attributes that neither the machine nor the human alone could achieve.

This article is set apart from most other Third Offset Strategy discussions by its consideration of the third opportunity: precision selection/training. Together with improving the machines (cyber initiatives) and improving the integration of machines into human performance (human-machine teaming), this aspect completes our triad of enhanced human performance by directly improving the way we select and train the humans in the loop (precision selection/training). In this area, we recommend using various initiatives such as so-called big data to inform our selection procedures, thereby taking advantage of the wealth of information that modern technology makes available.

Additionally, we recommend some large “cultural” changes in training procedures. Recent scientific advancements have opened new training opportunities, enabling us to begin training individuals on the basis of their individual needs. Rather than every Marine receiving the same training, individualized training protocols can address specific performance deficiencies or help an individual reach a particular goal or acquire a particular skill set required for a specific duty. This approach would make some training assessments more akin to medical

PERFORMANCE ENHANCEMENT TRIAD



Achieving the human-performance goals articulated by the Third Offset Strategy will require R&D initiatives on three fronts: (1) information-technology and cyber initiatives, especially in the areas of effective use of multiple, big datasets and assisted decision-making; (2) precision selection and training of human operators to ensure that the right operator is assigned the right task and receives task-specific training individualized to his or her needs; and (3) optimized human-machine integration, including simulated environments such as virtual and augmented realities.

assessments, with their related individualized treatment plans. There is already a model in place on which we can build: special operations. Our proposed precision selection/training ideas would use individual assessments and special operations forces (SOFs) training as the models for applying these techniques more widely, to the military at large.

These three components (cyber initiatives, human-machine teaming, and precision selection/training) represent our Performance Enhancement Triad, the overall model we recommend to guide Third Offset Strategy R&D. The article will now delve more deeply into each aspect of the triad.

Cyber Initiatives

Modern warfare no longer is limited to the physical battlefields of the sea, sky, and land. The ability to use global communication and data networks to disrupt directly the energy, financial, political, and military sectors of a nation is a reality. The most effective warrior of the future battlefield may not be the Marine with the rifle but the sailor or airman at a computer in Colorado. The conception of enhanced human performance needs to broaden enough to include these cyber warriors.

One illustration of enhancing human performance in the sphere of cyber warfare involves deep-learning systems. Machines can be used for cyber defense and electronic warfare; this may involve analyzing, for example, tens of thousands of social-media posts to identify critical data patterns that might be of use. Other technologies may sense unknown radar signals and help pilots sort tremendous amounts of information in real time without needing to return to base to conduct the analysis.¹ Either example represents a cyber initiative that attempts to circumvent the traditional limits of human performance. However, both systems actually are providing valuable information to the human operator to enable an eventual decision and reaction. Third Offset technologies, even seemingly cyber-only investments, fundamentally enhance human performance by creating new capabilities for the operator. The deep-learning systems remain a good example of a single “machine” that quickly can perform an operation that otherwise might take a single human operator weeks, thereby allowing real-time decision-making based on the most complete data analysis ever delivered to a combat environment.

Another emerging cyber initiative centers on antiaccess/area-denial (A2/AD) capabilities, or operations in denied and degraded environments. Any major operation depends on the ability to move forces rapidly in theater. Some analysts have even referred to operational warfare as an empty concept if forces are unable to conduct large-scale movements on land, at sea, and in the air.² Classic A2/AD methods have been aimed at denying a human operator access to some location; scenarios ranged from medieval caltrops stopping a cavalry charge to the use of various forms of land mines. In any such case, the goal involves protecting friendly forces, blocking enemy forces by denying them access, or both. Anti-A2/AD initiatives attempt to overcome these area-denial strategies. They can take one of two approaches: breaching the enemy’s A2/AD systems or enhancing friendly A2/AD capabilities. Third Offset substrategies could focus on enhancing the human operator’s ability to breach an area’s defenses. For example, new exoskeletons could reduce the danger to a human operator while he or she physically breaks through the enemy’s front lines.³ In the cyber arena, Third Offset technologies could extend the ability of the human operator to analyze quickly the status of global networks, then develop strategies to deny enemy forces access to the networks controlling energy, communications, navigation, and other critical infrastructures vital to waging war. On the flip side of the cyber coin, other Third Offset initiatives could pursue new technologies to ensure unimpeded cyber access by friendly forces. New A2/AD systems will need to survive cyber attacks and other enhanced defensive capabilities if our human operators and Second Offset technologies are going to continue to have the same impact on future operations.

Human-Machine Integration

Augmented performance through human-machine integration represents perhaps the most commonly cited component of the Third Offset Strategy. Augmented performance would enhance the human operator by providing more information, increasing functional capability, or maximizing performance and endurance in austere environments. The goal is to enhance situational awareness and operational performance by giving the operator directly everything he or she needs in the most convenient and expedient manner possible.

The foremost example of this idea is already well into development. Specifically, helmets can be equipped with AR aspects to create better HUDs than any prior system. The best-known example at present is the F-35 helmet, which can allow the pilot to “see” through the aircraft.⁴ This capability was made possible by advances in AR, which differs in several ways from virtual reality (VR) systems. With VR, the technology creates a self-contained world; all stimuli are created within that visual system, with no reliance on the physical world around the operator. In comparison, an AR environment does not create a self-contained world, but merely augments the world around the user by introducing computer-generated elements. Pilots wearing AR helmets still can see their cockpits, but other information will appear on their visors, such as current heading and altitude. The F-35 helmet uses this technology and cameras embedded in the skin of the plane to create a view for pilots that is unobstructed by the physical aircraft—they can “see” through the floor because they actually are looking at the camera images integrated into their visors. In a similar manner, Navy engineers are developing futuristic HUDs capable of embedding information on the inside of a diving helmet.⁵ The underlying concept is the same: to provide an operator—particularly an operator in a harsh environment or wearing protective gear—critical information that otherwise might be difficult to access or track.

Use of AR technology is not limited to the operational environment. In the training field, the Fleet Integrated Synthetic Training/Testing Facility (known as FIST2FAC) blends live action with virtual assets and adversaries.⁶ Thanks to this unique blend of live action and AR capabilities, sailors can stand aboard actual ships and simulate using machine guns to engage multiple fast-attack craft. The combination yields new training capabilities that otherwise would be possible only via an untenable financial investment. In other words, the blended training yields maximum training efficiency at minimal cost. This capability certainly falls under the general umbrella of an offset strategy, by creating a new and economically viable military advantage, while also fulfilling the Third Offset Strategy intention of enhancing human performance.

To demonstrate the effectiveness of human-machine teaming beyond merely providing information to the operator, we will draw on a now-classic example

drawn from the game of chess. It once was assumed that machines never would be able to outthink humans in this field, but a computer system named Deep Blue shattered this assumption when it beat world champion Garry Kasparov in 1997.⁷ Now computer systems regularly beat human players—which has spawned another evolution. The new format has different names (including three-play chess, freestyle chess, centaur chess, and so forth), but the premise is that during game play a computer aids the human.⁸ The human player can ask questions of the computer, which then compares various scenarios faster than the human could. The human player still makes the decision, but the computer provides invaluable aid during the process. The combination is not as simple as a HUD, because it involves comparing strategic moves and their consequences before the operator actually has to make the move. It is quite possible that future command-and-control equipment will integrate such technology platforms further into our operations. This is in keeping with the theme of “let the computers do what they do best, and let the humans do what they do best.”

The development of combined human-machine efforts faces other challenges, though, especially as the outcome performance can depend entirely on the specific machine involved and the specific human in the loop. Thus, the greatest challenge in human-machine teaming is trust. Although this phenomenon is not new, it remains a pervasive issue. Everyone is enamored of the capabilities of the newest computer—until it unexpectedly crashes and you get the “blue screen of death.” The driverless car currently is careening toward a wall of passenger mistrust that will have to be overcome.⁹ Third Offset technologies will face similar trust issues. Human operators must trust the accuracy and validity of the equipment they are using, or the entire synthesis becomes untenable. For example, the U.S. Naval Aviation Safety Center cites spatial disorientation as the number one human causal factor of Class A mishaps—the worst category of aviation mishaps, those involving more than two million dollars in damage and loss of aircraft, life, or both.¹⁰ Spatial disorientation can occur in a number of ways, with visual illusions often listed as a primary factor. In a visual-illusion scenario, operating in dark environments (or without visual reference points for some other reason) can disorient pilots. Despite instrument indications to the contrary, pilots continue to trust their eyes over their machine to fly safely—even when their eyes could be lying. Unfortunately, this is merely one example; human-machine trust issues are all too common. As new technologies are introduced to aid the warfighter, the issue has the potential to become much more significant.

Precision Selection and Training

While cyber initiatives will provide superior “machines,” selection and training initiatives will be pivotal in ensuring that those machines are integrated with the

best possible human operators. The key to success for these selection and training initiatives will be precision. Traditional military selection and training have been a matter of mass production, in which sailors and Marines are treated as identical cogs in a giant machine. Current screening tools, such as the Armed Services Vocational Aptitude Battery (known as ASVAB), are notoriously blunt instruments that ignore the developing science of incorporating physiological, neurological, and cognitive components. Furthermore, the military has a long, proud tradition of being able to take any motivated man or woman, regardless of background or aptitudes, and train him or her to be an effective soldier, sailor, Marine, or airman. While this approach may have worked in the era of mass armies and large-unit tactics, the fluid battlefield that is characteristic of fourth-generation warfare and cyber warfare makes this selection and training approach obsolete—and risky.

It will not be sufficient to have just any sailor pushed through a training pipeline; for the Third Offset Strategy to succeed, the military must push the *right* sailor through the pipeline. In other words, decisions regarding selection and training must be made with a precision never seen before in the U.S. military. In the world of the Third Offset Strategy, selection and training decisions would be more similar to those a doctor makes in treating a patient, involving creating an individualized plan designed to achieve the optimal outcome. In fact, the research techniques designed to discover the biomarkers to be used in this new era of precision medicine also may help usher in the precision selection and training approaches necessary for the success of the Third Offset Strategy.

The difference in warfare environments between current and future operations further makes this “precision challenge” both timely and apropos. A large, blunt training procedure cannot deal with the nuances that the conduct of multigeneration warfare creates.¹¹ Fortunately, a model already exists for conducting this style of military training. The SOFs template is the ideal base on which to build. SOFs already embody several aspects that are essential to meeting current operational-flexibility demands, including the need to conduct smaller, dispersed engagements and perform expedited responses. SOF operators are among our best-trained and most capable military personnel. If we are going to build a mold from which to cast future operators, SOFs offer an ideal subset to consider in determining how to select and train human operators.

The template begins by adopting some of the basic truths applied to special warfare for application across a wider segment of the military. The U.S. Army Special Operations Command dictates five truths about SOFs, which can serve as a philosophical guide for selection and training. The first truth states that “[h]umans are more important than hardware.” The fourth truth states that “[c]ompetent Special Operations Forces cannot be created after emergencies

occur.”¹² Preparation during peacetime aligns well with the spirit and general purpose of an offset strategy. So, from a philosophical perspective, SOFs already apply the template for human operators that will be needed to carry out a Third Offset Strategy.

Of course, the general purpose of personnel selection and screening is nothing new. For especially important duties, the different service branches long have sought better means of selecting and screening personnel, ranging from combat-readiness evaluations to special-operations training. The question remains the same—How will we achieve this end goal?—but the difference now is the tools we have at our disposal to make these evaluations. For example, deep-learning systems take advantage of “big data” analytics, which can crunch numbers far more quickly than human analysts. These advanced analytical approaches can be used to enhance our existing selection procedures by using as a starting point the personnel we have already, along with the requirements of the duty in question.

This idea sounds rather vague until one considers a specific application. One example is that big-data analytics and new research could be used to develop a combat-readiness profile (CRP).¹³ The CRP would identify numerous physiological, cognitive, and neurological components to predict which individuals will have the highest likelihood of performing well under particular combat conditions. Physiological variables to be measured might include heart-rate variability, cognitive factors, and response inhibition; neurological variables might include event-related potentials in the brain.¹⁴ These rich sources of information provide an insight deeper than does outward behavior alone, because they literally identify activity going on in the hearts and minds of our personnel. Recent technological developments have continued to make sensors of these various factors smaller, more durable, and more practical to employ in otherwise difficult-to-access environments. By taking advantage of this available yet underused data source and big-data analytics, we could evaluate combat readiness in a manner never attempted before in military history. The ability to quantify combat readiness on the basis of objective factors could supplement training officer decisions by identifying precisely those individuals who are and are not ready for combat—no matter how they appear to behave under pressure during training.

The potential to select personnel precisely represents an interesting new way to enhance operator performance in the Third Offset Strategy: by matching the right operator to the right duty at the right time. There is an opportunity to take these selection mechanisms one step further by developing new training methods that are based on human abilities that current military training underemphasizes—specifically, cognitive abilities. The idea stems from a concept called “Sharper Minds, Sharper Sailors.”¹⁵ Essentially, we currently train the bodies of our personnel through physical training and we give them new

procedures to execute and new technology to operate. However, the thing that operates that body, executes the procedures, and uses the technology—the mind—receives no directed training. But if we enhance the mental capabilities of our personnel, we could expect to improve operational effectiveness. Thus, the Third Offset Strategy takes a rather direct approach to enhancing human performance of military duties: by enhancing the human who will be performing the duty.

The challenge is in identifying how to enhance the individual operator. So-called brain-training initiatives have purported to cure everything up to and including Alzheimer's disease by having subjects perform a few minutes of directed cognitive-training tasks each day. However, the Federal Trade Commission (FTC) slapped key elements of the brain-training industry with fines for making such grandiose claims with no empirical evidence.¹⁶ Even the scientific community is somewhat split over the issue, with many lining up to denounce the entire brain-training industry, while others proffer the simpler criticism that so far the industry has overstepped any reasonable conclusions.¹⁷ Scientists still are learning which cognitive training platforms can be used as interventions for which problems, and how the training methods should be applied. Nonetheless, the field holds substantial potential, with promising preliminary results being replicated in new studies. For example, alcohol-consumption behaviors can be altered by increasing response inhibition for alcohol-related stimuli (e.g., pictures of beer).¹⁸ This example demonstrates how sound science paired with specific intent can achieve a worthwhile goal. The success comes from careful application of validated scientific methods. In comparison, the brain-training industry rushed an idea forward for immediate profit without generating any supportive evidence for its claims.

Military research cannot make the same mistake. Developing new training techniques must be an evidence-based endeavor. As noted above, response inhibition appears to be a trainable cognitive function, and this cognitive ability has direct relevance to combat operations.¹⁹ Classic response-inhibition experiments often use a "go/no-go" task, in which one stimulus is paired with making a response and another stimulus is paired with withholding a response. For example, participants in these experiments might hit a key (i.e., a "go" response) whenever they see a green square, but withhold a response (i.e., a "no-go" response) whenever they see a red square. The transition to a military operational environment can be very direct—shoot a hostile in a combat zone (i.e., a "go" response), but do not shoot an ally in a combat zone (i.e., a "no-go" response). Such a link between inhibitory control and either friendly-fire incidents or civilian casualties already has been demonstrated in the psychology literature and, in a more direct application to the training issue, there is at least one demonstration that

response-inhibition training could reduce the likelihood of inflicting a civilian casualty.²⁰

These examples demonstrate how the Third Offset Strategy should pursue new training methods to maximize human performance. Specifically, any novel approaches should be (1) based on sound science, (2) demonstrated in a context relevant to military operations, and (3) replicated in different experiments before the proof of concept is turned into a concept of operations. For example, we should not hesitate to explore novel technologies, such as transcranial stimulation, to enhance human cognitive performance, as well as to leverage our understanding of the neurobiology of fatigue to mitigate its adverse cognitive effects.

A REALISTIC BALANCE BETWEEN HUMAN OPERATORS AND TECHNOLOGICAL GOALS

Our argument is that an agenda that addresses enhanced human performance would satisfy best the timeline, priorities, and deliverables that our current operators face. Still, any Third Offset Strategy argument should not address simply satisfying these criteria; rather, the discussion should hinge on these criteria themselves. Anything discussed should focus on realistic R&D goals that achieve some measure of increased operational readiness or expanded force capabilities. For example, consider two novel technologies currently under discussion for fulfilling future naval purposes: AR and AI. The question then becomes whether AR or AI systems meet our three needs of priorities, tangible deliverables, and a timeline (i.e., which technology should be our focus?).

AR technology exists today in an ever-growing commercial market, and it would be easy to program the scenarios to fulfill military requirements. But how well does AR match up against our three needs—does it match our priorities? Yes. One of our greatest challenges at the moment is that our new strategies must be flexible and must adapt to a wide array of adversaries, including the “4+1” concept that identifies four potential adversary states (Russia, China, Iran, and North Korea) and various nonstate actors (e.g., terrorist organizations).²¹ Each possible adversary presents different challenges, so our training and operational activities must be flexible enough to adapt to and overcome those challenges. AR training can be programmed to mimic a wide array of situations, from operating a gunner platform firing at fast-attack craft to planning high-volume troop movements. AR also can provide advanced operational capabilities, such as the various information displays within the F-35 helmet. Does AR provide tangible deliverables? Yes. In the near future new technological capabilities could be demonstrated that would provide the needed equipment, and we can measure human-performance differences to determine their operational impact. Can AR meet a realistic timeline? Yes, the technology as it exists today can be adapted to

fit any of these suggested purposes. AR systems represent an ideal technological template for Third Offset improvements and investments.

AI systems could alter the battle space dramatically, with thinking machines adapting to overcome new problems faster than communication signals could be relayed to an operator. An entire army of thinking machines could overwhelm an enemy battalion without ever losing a human life. The idea already is swimming about in the conceptual seas of both allies and adversaries; Russian general Valery Gerasimov recently predicted a future battlefield populated by learning machines rather than humans.²²

But as interesting as these possibilities may be, would drones or some other form of AI meet our three needs? Is overwhelming our enemies a priority? Absolutely. Does AI offer tangible deliverables? Yes—but in enough different forms that an acquisitions officer could go from butter bar (O-1) to full bird (O-6) before seeing a final, delivered product. Is such a timeline acceptable? Definitely not. We should continue to invest in these capabilities—their potential is nearly endless and the technology could revolutionize warfare. But will swarms of drones dominate the battlefield by 2030, or even 2040? Given the challenges of technology development, infrastructure, manufacture, and acquisition, the safe answer is no.

Typically from this point, Third Offset Strategy writings would continue down the road of discussing technological opportunities, but we are focusing on enhancing human opportunities. However, confusion can arise when discussing the source of these enhancements. We are not suggesting that human performance should be enhanced *separate from* advancing technology; we are suggesting that human performance should be enhanced *through* technology. Advanced technological capabilities will provide new opportunities to achieve optimal human performance. This approach adheres to the theme of “let the computers do what they do best, and let the humans do what they do best.” Computers can process information faster than human operators, so let the computers crunch the numbers; human operators can make decisions that incorporate a level of context and consequence that computers cannot, so let the humans make the decisions.

A CULTURAL CHANGE: THE CONSEQUENCES OF PURSUING HUMAN-PERFORMANCE ENHANCEMENT

The ideas introduced thus far largely are novel in and of themselves, and integrating them into our ongoing operations—making them a reality—will require changes in the areas of personnel, equipment, and funding. But several suggestions would require more: major cultural changes.

One important issue deriving from the advancements in cyber capabilities was referred to earlier: that the most effective warriors may be the sailors, airmen,

or others who remotely pilot vehicles that have a direct battlefield impact. This idea seems to conflict with our advocacy of a SOF-type approach to personnel selection and training, but the two elements actually dovetail quite well. Precision selection procedures can be applied to both realms; the difference is in the abilities assessed to select operators to fill various roles. Some selection procedures will focus more on the overtly physical (e.g., physical fitness evaluations, long-distance swims, etc.), whereas others will focus more on response speed and fine-motor control (e.g., hitting buttons quickly, making microadjustments with joysticks). However, this differentiation merely reflects variations in specific procedures; the greater challenge will require effecting cultural changes in how we view certain training and procedures.

The first cultural change involves an emerging trend regarding the battle space, not the battlefield. *Battle space* quickly is coming to be defined by multiple entities operating in multiple locations across multiple platforms. Whereas we once fought the battle of Saratoga in upper New York State, a future “battle of Saratoga” may involve airmen in Saratoga operating remotely piloted vehicles to survey a land area in Iran, causing fighter jets (or maybe even other drone aircraft) to launch from an aircraft carrier in the Persian Gulf to strike a location in Syria. This is battle space, not a battlefield—multiple domains coordinated in real time to conduct operations across the world.

This aspect is actually the cultural change that most in the military will accept readily. The real cultural change will be to take those same procedures and ideas that we have applied only to special operators and apply them to our larger force. If drone pilots may be launching aircraft from Colorado to aid special operators in the Middle East, we must hold those operators to the same standards as our special operators in theater—perhaps not in the number of push-ups performed or the marksmanship exhibited, but in remaining in the top 1 percent for reaction time or fine-motor control.

More than that, the same principles applied to special operators could apply elsewhere. For example, consider the special operations truth cited earlier that “[h]umans are more important than hardware.” Our best and most advanced tactical aircraft—manned or unmanned—are nothing but expensive paperweights without their operators. As noted earlier, “[c]ompetent Special Operations Forces cannot be created after emergencies occur.” If we need a flexible force operating aircraft from stateside to fight overseas, then its personnel must be ready before the emergency occurs. Those operators may not have to sleep in camp tents or fend off desert bugs at night, but they still have to be ready when the alarm sounds. We still train for the top 1 percent of operators; why should the underlying selection and training principles for our special drone operators be different from those applied to our special operators in the field?

To employ a common metaphor, we are talking about changing how we view the “tip of the spear.” The spear no longer is hurled at the enemy by one person. Many highly trained operators from many different locations are coordinating to throw “spears” that are far more sophisticated. However, if the tip of the spear is no longer isolated to one physical location—the battlefield as we knew it—then sharpening that spear means keeping it sharp everywhere it will be lifted. Personnel-wise, this includes the special operator on the ground, the drone operator conducting reconnaissance, and others. Sharpening the spear in this sense means identifying the best human operators and enhancing their performance to peak levels. SOF truths are the perfect model to guide us in applying these ideas to human operators outside of SOFs.

Another big cultural change involves how we go about making these ideas a reality. As mentioned earlier—and proudly reaffirmed here—the military has a long tradition of being able to take any motivated man or woman, regardless of background, and train him or her to be an effective soldier, sailor, Marine, or airman. The current operational model is akin to that of a factory machine. The goal is to take raw material and conduct training until all aspects of that raw material perform and function in the same way. For more-specialized operations, we select people for the necessary roles on the basis of existing capabilities: Can they pass the test, or survive the experience?

Our take on precision selection directly contradicts this process. We do not provide the same training to everyone; rather, we identify individual strengths and weaknesses and train individuals to reach a given standard. Identifying training opportunities that address individual weaknesses enhances the training process. We help the individual achieve the necessary standard faster by identifying his or her current individual capabilities and focusing on those areas that are not yet up to standard. Sailor Smith and Sailor Jones no longer get all the same procedures—some, to be sure, but not all. Sailor Smith receives the training he needs, and Sailor Jones receives the training she needs.

This process can be focused all the way down to a cognitive level because performance problems can occur for many reasons, such as insufficient sleep or low morale or poor cognitive functioning. The roadblock that must be negotiated is the identification of the criteria on which we would make these precision selection and training assessments. We need new procedures that identify cognitive skills and capabilities that current training does not address directly.

This approach can achieve optimal human performance, and it represents the greatest opportunity for the Third Offset Strategy to have a real and long-lasting impact on U.S. military operations. However, it will require a basic shift in how we consider and pursue selection and training—a shift that can begin by adapting SOF principles and truths to a wider array of military activities.

COMPARING OFFSET STRATEGIES: WHAT SHOULD WE LEARN FROM PREVIOUS INSTANCES?

As its name makes obvious, the Third Offset Strategy is not the first of its kind. We have been down this road and used this approach to great effect throughout the latter half of the twentieth century. The previous examples can provide more than just historical context. Lessons learned from the previous strategies can be applied to the Third Offset Strategy to ensure its greatest possible effect.

The discussion that follows of the First and Second Offset Strategies will address the following questions:

1. What constitutes an *offset strategy*?
2. In the previous offset strategies, what considerations were given to the human operator?
3. What factors created the longest-lasting benefits?
4. What factors created the most-volatile situations?

Defining an Offset Strategy

While the term *offset strategy* has entered military jargon fully, there does not appear to be a consensus on what qualifies an approach as an offset strategy. Recent communications from senior DoD officials have called for a Third Offset Strategy, but these mostly provided a general direction and a common language for discussions about military R&D priorities in the early twenty-first century.²³ Other writings have described a variety of technologies that the Third Offset Strategy should pursue.²⁴ Perhaps the only universally agreed-upon point with regard to the Third Offset Strategy is that we are reaching an era in which American dominance on multiple fronts—sea, sky, space, and cyberspace—no longer can be taken for granted.²⁵ But what is an offset strategy, and why would having one help us now?

One definition of an *offset strategy* as a military tactic relies on the following three criteria:

1. **Asymmetrical advantage:** A nation seeks to compensate for a military disadvantage or force disequilibrium by attaining an advantage the adversary cannot match.
2. **Unconventional approach:** Simply increasing the size of existing forces to achieve the desired military advantage is not an option owing to fiscal, political, or practical constraints. Instead, a nation pursues some novel approach—through tactics, technology, or some combination thereof—to achieve the advantage.

3. Long-term sustainability: The novel solution must be sustainable over the long term, without an excessive drain on the national economy or military budgets.²⁶

An interesting note is that, when taken together, the latter two criteria produce a maxim for an offset strategy: maximum deterrence at minimal cost. An offset strategy gives a military an advantage that an opposing country cannot match; it accomplishes this goal by using unconventional means, primarily aimed at deterrence; and the military maintains this advantage for a long period. This maxim also indicates why a nation might pursue a particular course of action. Generally speaking, practicing deterrence is an economically efficient approach that does not require a nation to relinquish its military advantage.

Historical Context of the Previous Offset Strategies

Two previous cases in U.S. history often are held up as examples of offset strategies. The First Offset Strategy originally was called the New Look. The most narrow sense of the term merely described the DoD budget for fiscal year 1955.²⁷ During the Cold War, the United States faced a monolithic adversary in the Soviet Union. Matching Soviet conventional resources would have cost the United States more than three times its entire defense budget, which would have led to an “unbearable security burden leading to economic disaster.”²⁸ President Eisenhower and his administration decided to shift tactics. They found a military advantage that would deter the Soviets without needing to match conventional forces—the First Offset Strategy.²⁹ In short, they offset a conventional weapons disadvantage with a nuclear weapons advantage. The United States thus opted to pursue nuclear deterrence via a policy of massive retaliation rather than by matching conventional forces.³⁰ The First Offset Strategy appears to have been successful for a time—military expenditures, as a percentage of the total budget, declined, without sacrificing overall U.S. military strength.³¹

The Second Offset Strategy began to emerge once the Soviet Union neutralized the U.S. nuclear advantage. With mutually assured destruction a reality, both nations could rely on conventional forces only, and in that area the Soviet Union still held a mammoth advantage over the United States.³² Again, matching those conventional forces would have bankrupted the United States and NATO. (Thus, economic concerns emerge yet again as a critical factor in determining why a nation would pursue an offset strategy instead of conventional superiority.) The solution came not in nuclear yield but through precision. The trick was to take human error—the inaccuracy of human operation of the targeting systems—out of the equation, so as to guarantee mission accomplishment. The role of the human operator changed in the Second Offset Strategy; precision accuracy was achieved through technology, not via human aim. The result exceeded all expectations. By

1984, a top Soviet official called one Second Offset program, Assault Breaker, a “military-technical revolution,” a formulation that morphed into the American axiom “a revolution in military affairs.”³³ American precision capabilities could destroy two thousand Soviet tanks, from miles from the front lines, in less than a day.³⁴ Second Offset advantages put American capabilities ahead of Soviet conventional forces—yet again without having to attempt the unsustainable investment necessary to match forces soldier for soldier.

Ultimately, the United States managed to maintain a military advantage without experiencing economic collapse, whereas the Soviet Union did not fare so well. Many different factors contributed to the eventual dissolution of the Soviet Union—which factor was most influential is debatable—but economic issues certainly contributed.³⁵

Second Offset Strategy advantages proved durable over decades, leading to continued U.S. military successes. Both Gulf Wars demonstrated the advantage of Second Offset technologies over adversaries unable to match that technology.

Lessons Learned: The Role of the Human Operator in Previous Offset Strategies

With regard to the First Offset Strategy, human operators armed with conventional weapons represented an unsustainable economic weakness—the United States could not attempt to match its forces against Soviet-led capabilities. It also could be argued that large armies represented a tactical vulnerability; after all, in the nuclear world, large standing armies became optimal targets that could be eliminated with a few nuclear bombs. Another consideration of the First Offset Strategy was a secondary, but no less important, liability: the dependence on error-prone, sometimes unpredictable, human operators.

The Cuban missile crisis demonstrated this issue, although the specific incident in question is not widely known. Typically, Soviet submarines could launch nuclear weapons if the captain and political officer agreed to the action. Aboard *B-59*, however, nuclear launch required the approval of a third officer: Vasili Arkhipov. He was second in command of *B-59*, yet also commander of the submarine flotilla. This authority made him equal in rank to the captain and gave him a say in whether nuclear weapons could be launched. When several practice signaling depth charges dropped by USS *Beale* (DD 471) struck the boat’s hull on October 27, 1962, the captain and political officer wanted to launch a nuclear torpedo against the U.S. fleet.³⁶ Only Arkhipov disagreed—thereby preventing an action that likely would have escalated the confrontation into full-scale nuclear war.³⁷

Because of the tactics involved in the application of the First Offset Strategy, tens of millions of American lives came down to the actions of a single man—and not even a member of the American military. He easily could have acted

differently; in fact, two of the three men in his situation, on the same submarine, did act differently. While we are all thankful for Arkhipov's discretion, the events on *B-59* reveal the potential danger of trusting so many individual human operators to execute reliably a First Offset Strategy that relied on a consistent willingness to use the apocalyptic power of nuclear weapons when necessary. Thus, the human operator represented a multifaceted liability within the First Offset Strategy.

For the Second Offset Strategy, the human operator shifted from being a liability to a cog in the machine—a button pusher. Precision guidance required taking the human out of the targeting systems as much as possible and letting computer systems guide our birds to their targets. While the extent to which precision guidance relegated human operators to being mere button pushers could be argued, it is clear that the role of the human operator changed significantly. In many cases, once a decision to engage the enemy was made the human operator was consigned to being a bystander.

Beyond considering the role of the human operator in each strategy, we can learn from what each strategy did effectively. The First Offset Strategy did succeed, although its advantages were volatile and short-lived. Its continuing contribution is the concept of mutually assured destruction; however, today this reality affects our immediate and practical operations very little. A weakness of the First Offset Strategy was that its tactical contributions were eliminated almost entirely once other countries achieved nuclear parity. The Second Offset Strategy fared much better in that regard. Specifically, precision weapons are as useful today as they were in the 1980s. We have not discarded these capabilities, and they continue to impact our ongoing operations. The Second Offset Strategy had to start fresh because it could not build on the advantages the First Offset Strategy had achieved. The Third Offset Strategy can build on Second Offset Strategy advantages, and that aspect should be considered as we plan for the new strategy. Our long-term goals should be to develop capabilities that future developments cannot simply eliminate or overwhelm. This idea further confirms enhanced human performance as an ideal focus for the Third Offset Strategy, because the performance procedures we develop now will continue to be useful long after the Third Offset Strategy itself enters the history books.

Another important difference between the emerging offset strategy and its predecessors involves how we will pursue these technologies. Unlike the earlier approaches, we are well aware that a new strategy is emerging; whereas the previous strategies scrambled to address existing challenges, this time we have the opportunity to be proactive. This awareness allows us to design our approach in a more deliberate fashion than with the previous methodologies. This point becomes more important given that the Third Offset Strategy is really a series

THE HUMAN IMPACT ON OFFSET STRATEGIES

Offset Strategy	U.S. Personnel	Adversary Personnel
First Offset: nuclear deterrence	Liability: The economic and logistical challenges of fielding U.S. personnel in the numbers necessary to win a conventional war made them a liability.	Tyranny of numbers: The Soviet Union and the Warsaw Pact could field an army in Europe substantially larger than NATO was willing to support.
Second Offset: precision conventional weapons	Source of error: The complexity of the modern battle space exceeded the capabilities of the human being to engage the enemy effectively and rapidly without unacceptable errors, requiring development of strategies to remove the human element to the extent possible.	Remote and hidden: Nonstate actors strike from locations hidden in urban environments, while more-traditional state enemy forces hide behind a shield of overwhelming numbers of conventional weapons. Both scenarios create a tremendously complex battle space.
Third Offset: enhanced human performance	Strategy focus: Astonishing advances in information technologies allow presentation of an overwhelming array of data to human operators and their commanders. Enhancing the physical, cognitive, and decision-making capabilities of the human operator becomes central to successful military operations.	Flexible: Advances in cyber (Internet, mobile communications, etc.) and other technologies allow enemy personnel to operate without the limitation of state borders. Management and synthesis of complex data from multiple sources are required to track and target enemy personnel effectively.

of smaller strategies all working toward the eventual overall goal of enhanced human performance. To that end, we can construct a more theoretical guide to identify, describe, and structure concurrent efforts.

The United States employed two offset strategies during the twentieth century as means of creating viable and sustainable military deterrents. The First Offset Strategy developed principles of nuclear deterrence and massive retaliation that, while effective at the time, were flawed in that they treated the human being as a necessary liability. Both offset strategies were employed to great effect and maintained a military advantage throughout the latter twentieth century at a minimal cost. This fiscal component proved vitally important, as the continual buildup of conventional military forces contributed to the collapse of the Soviet economy, while the U.S. economy endured.

Unfortunately, the significance of precision weapons in maintaining a military advantage is dwindling as other nations develop similar technologies. The revolution in communication and information technologies as well as the involvement of nonstate actors has created challenges never before seen. Additionally, the advent of fourth-generation warfare and cyber warfare threatens to make Second Offset technologies less relevant.³⁸ A new offset strategy is required. Although the Third Offset Strategy remains in its earliest stages of development, central to its success will be the human operator. Current and future battle spaces will be global and multidimensional, with the only common element across the dimensions

being the human being. By emphasizing the human element, the Third Offset Strategy can create an asymmetrical advantage that potential adversaries will be unable to match. Previous offset strategies limited the human element; the First Offset Strategy viewed the human operator as a fiscal liability (i.e., maintaining conventional strength could be considered too expensive compared with maintaining nuclear weapons), and the Second Offset Strategy tried to minimize human error by removing the human from the equation as much as possible.

Now we propose the opposite: to maximize human performance through emerging technology and new systems, from human-machine combat teaming to assisted human operations.³⁹ This new offset strategy incorporates distinct roles for both technological innovation and the human operator, as well as leveraging the capabilities of both to create an advantage greater than either could achieve alone.⁴⁰ To provide platforms for these new capabilities, we propose efforts in three key areas.

- Cyber initiatives and “big data” can sustain operations in previously denied environments, process information more quickly than human operators could, and ensure that the most-reliable and most-accurate information is delivered to the operator.
- Human-machine teaming will become essential for both operations and training, but this integration presents a host of new challenges for which Third Offset Strategy initiatives must prepare.
- Precision selection and training can produce the individual enhancement and flexibility our future forces will require, and we should build this precision model on the truths embraced by SOFs and using all available tools, including those being pioneered as part of the precision medicine revolution.

Ultimately, the Third Offset Strategy should take a new tack, one that seeks to maximize human performance by using new evidence-based technologies to provide task-specific personnel selection; create individualized, competency-driven training; optimize the operator’s physical, cognitive, emotional, and decision-making abilities; and augment warfighter capabilities in the field through well-researched and proven human-machine integration. In short, as the fundamental framework for a successful Third Offset Strategy, we propose a Performance Enhancement Triad consisting of cyber initiatives, human-machine integration, and precision selection/training. Constructing each component of the triad will require a broad strategic investment in an equally broad array of technologies. Working across these three domains, the ultimate goal will be the enhancement of human performance. Although constituting a dramatically different philosophical approach and practical application from the previous offset

strategies, a focus on human performance may represent a viable, economically sound method of creating new military advantages over potential adversaries for the twenty-first century.

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40. It is worth reiterating a subtle but important philosophical point here. The Second Offset Strategy sought to achieve maximum effort through precision and minimal error. In that context, minimizing human error required removing the human from the operation as much as possible. In contrast, the Third Offset Strategy seeks to enhance human performance. Although enhanced performance also seeks to minimize human error, the basic approach is to do so through improved human performance rather than by minimizing the role of the human operator. Another subtle difference is that enhancing human performance is about not only avoiding errors but improving performance ceilings as well.

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