Precision Misses the Mark

SAW 2001

Subject Area Aviation

Precision Misses the Mark

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21 May2001

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2001		**00-00-2001 to 00-00-2001**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Precision Misses the Mark	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Marine Corps War College,Marine Corps University,Marine Corps Combat Development Command,Quantico,VA,22134-5067**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**20**	

Executive Summary

The US military is increasingly relying on "precision" to ensure its dominance over future adversaries. The operational concept of Precision Engagement is an essential component of joint and service visions of future war. We are spending billions of dollars to develop smaller, more precise munitions to produce effects tailored for specific target sets. Proponents believe that precision guided weapons (PGWs) represent a revolution in military affairs that has fundamentally affected the way wars will be fought.

Continued emphasis on precision weapons and reduction of collateral damage during attacks is not only unnecessary for US victory in future wars, it may actually be counterproductive. The development of smaller, more precise weapons is driven more by our compulsion to avoid collateral damage than by military expediency. Limitations in intelligence, sensors, response time, and baffle damage assessment prevent us from fully leveraging current PGW capabilities, which are already good enough to destroy any target we can identify.

Our future adversaries will be adaptive and will find ways to mitigate the overwhelming firepower advantage that PGWs provide. Terrorist organizations and other non-state opponents may not possess an infrastructure amenable to precision attack. More developed foes will disperse and hide their vulnerable targets or find ways to make them politically unpalatable to attack. Cheap countermeasures can and will be developed to foil our expensive systems.

PGWs have not fundamentally changed the nature of war and will not ensure success. We should focus our procurement efforts on cheap, accurate, and versatile weapons. Our nation and military must discard the fallacy that future wars will not involve casualties and sacrifice. It is not the single technological feat of guiding a weapon to a precise set of coordinates that will make us preeminent in future conflicts, but rather the employment of a truly integrated joint force that can seamlessly employ fire and maneuver throughout an entire area of operations.

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Precision Misses the Mark

Today's state-of-the-art precision weaponry affords an attacker the capability to engage any enemy target he can identify on the surface with very high confidence that a single strike will attain the desired effects with a relatively small expenditure of resources and minimal collateral damage. Wars against an enemy lacking this capability have been decidedly one-sided affairs. The United States is investing tremendous amounts of research and development money on further improving our ability to precisely strike critical fixed targets, and the concept of precision is prominent in our operational concepts for the future. However, an objective consideration of our potential enemies and their projected capabilities indicates that even a highly refined precision strike capability will not ensure deterrence or victory in a future conflict. Adaptive enemies, cheap countermeasures, political restraints, technological limitations of sensors, and the tremendous cost of these weapons will combine to prevent precision from becoming the panacea that revolutionizes warfare and confers dominant advantage to our technological prowess in future war scenarios. *Our over-reliance on precision weaponry in our future operational concepts creates a serious unintended consequence, namely that we will fail to influence the will of our enemy if we limit ourselves to this high-tech version of attrition warfare.*

Precision Guided Weapons (PGWs) are munitions that are capable of receiving guidance corrections during their flight to the target.[1] They fall into one of two general categories: man-in-the-loop, or autonomous. Man-in-the-loop systems require steering commands from a person with eyes on the target, either directly or via a sensor. These systems are nominally less sophisticated and less expensive than autonomous systems, but may be better at discerning a target in a cluttered or camouflaged environment, or finding one that has moved. The principal

drawback of these systems is that the man in the loop may be at risk. Autonomous systems are fire-and-forget weapons that can be launched from outside the range of enemy defensive systems. They rely on internal (INS or digital mapping) or external (GPS) navigation to fly to the target area and some sort of target imaging sensor (radar, laser, infrared, or a combination) and an acquisition algorithm for final guidance.[2]

The Promise of Precision

PGWs promise such an exceptional advantage in warfare that they have been heralded as the centerpiece of a recent revolution in military affairs. Air Force historian Dr. Richard P. Hallion has stated, "Undoubtedly, one of the most important developments in the history of twentieth century warfare has been the emergence of the precision weapon..."[3] Pushing the case further, George and Meredith Friedman, in their book, The Future of War, contend that the development of precision weapons "ranks with the introduction of firearms, the phalanx, and the chariot as a defining moment in human history."[4] It is hardly surprising then, that the US military, particularly the Air Force as the most vocal proponent of precision engagement, has come to view precision as a panacea that will provide a decisive advantage in future conflicts.

As outlined in Joint Vision 2020, Precision Engagement represents one of four important capabilities of the joint force. It is defined as, "the ability of joint forces to locate, surveil, discern, and track objectives or targets; select, organize, and use correct systems; generate desired effects; assess results; and reengage with decisive speed and overwhelming operational tempo as required, throughout the full range of military operations."[5] At the heart of this revolutionary capability is a system-of-systems incorporating battlespace awareness, advanced

C4I, and precision force.[6] Using such a system-of-systems, the Air Force promises the ability to "find, fix, assess, track, target, and engage anything of military significance, anywhere."[7]

The presumed accuracy and lethality of PGWs also promises to reduce the number of weapons and delivery platforms required to wage a campaign and to reduce the size of the weapons themselves.[8] Applying the "one weapon equals one target" paradigm to the critical infrastructure nodes that could cripple an adversary proffers a very resource-efficient battle. Without the need to launch a large number of inaccurate ballistic weapons against each target, the need for large armies, large industrial plants, and a large merchant marine recedes. Precision accuracy also allows smaller weapons with less explosive power to be employed, further reducing the already limited amount of collateral damage from attacks.

The Nature of Potential Adversaries

The key assumption of Precision Engagement, often neglected, is that our adversaries will be susceptible to our firepower. However, we may be guilty of "mirror-imaging" our vulnerabilities onto rivals who are actually very different from us. The United States is a high-tech industry- and information-based society with identifiable critical vulnerabilities. Our military relies on limited ports-of-entry to project force and sophisticated communications systems to control it. We abhor friendly casualties and are becoming increasingly reluctant to accept even enemy deaths. The US is arguably the most vulnerable to precision engagement because we often lack the requisite political will to remain engaged in the face of mounting casualties and are increasingly unprepared to fight without the benefits of information dominance and near-perfect battlespace awareness. We should not expect enemies who do not share our sensitivities or our dependence on technology to be similarly affected.

As Clausewitz would surely point out, our enemies will be adaptive. Recent conflicts have taught ample lessons about how to mitigate the effects of our firepower. By distributing assets thinly over the battlefield, dispersing essential infrastructure, and maintaining even a rudimentary air defense capability, a shrewd enemy can force us into an extremely costly expenditure of stand-off precision weaponry.[9] They will play off our critical vulnerabilities: aversion to casualties and collateral damage, sensitivity to domestic and world opinion, and lack of commitment to long-term campaigns.

There are numerous examples of how a technologically inferior enemy can frustrate our advanced capabilities. During the Vietnam conflict, the Viet Minh adopted dispersed small unit operations using few supply lines and logistics sites to foil our interdiction efforts.[10] The Iraqi army constructed berms around their tanks to ensure that our aircraft could only destroy one per pass. They placed burning tires next to vehicles to spoof IR seekers and sporadically fired AAA to keep attacking aircraft at high altitude, reducing the kill per pass ratio even further. Recently, the Serbian army demonstrated its ability to gain operational objectives quickly and then to disperse or meld into the population to avoid aerial attack.[11]

Attrition Warfare vs. Attacking the Opponents Will

Precision Engagement is a form of attrition warfare. It allows the systematic destruction of targets on a prioritized list in the hopes of weakening the enemy's ability or will to continue the conflict. Quoting Dr. Hallion again: "Increasingly war is more about destroying or incapacitating things as opposed to people. It is now about pursuing an effects-based strategy, rather than an annihilation-based strategy, a strategy that one can control an opponent without having to destroy him."[12] The danger of pursuing such a strategy is that, if the enemy doesn't

perceive the destruction of his infrastructure as a grave threat to his personal safety or ability to remain in power, we may surgically miss the will of the enemy while systematically eliminating his physical objects. In cases where "our quarrel is not with the people" of a nation but with its despotic leadership (who may have little regard for his subjects' suffering) it is difficult to see how precision engagement of infrastructure targets can alter our adversary's will.

Attempts to employ attrition warfare to eliminate the enemy's capability to continue fighting are frequently frustrated by a thinking/reacting foe. As the Germans found out at Verdun, and the United States learned in Vietnam, even a much weaker adversary can bring a numerically or technologically superior opponent bent on attrition to a stalemate. The recent experience in Kosovo, though proclaimed a success, presented a dilemma that we may have to consider in the future. What happens when the target list is exhausted and our foe still refuses to give up? Our generous efforts to avoid collateral damage further lessens the morale effect of our attacks and may be counterproductive to influencing enemy will.

Uncertainty as to what is being targeted and where weapons will fall can have a significant psychological effect on an enemy. This effect is absent when only discrete items of equipment and infrastructure are targeted with no apparent risk to personnel or equipment outside of a very small lethal radius. Even a casual observer of the recent conflicts in the Persian Gulf and Kosovo can deduce our future targeting priorities fairly accurately. Our efforts to develop smaller, more precise weapons to provide tailored, local effects confronts our adversary with very little physical risk as long as he keeps away from tanks and power stations. Interviews of captured Iraqi soldiers during the Gulf War revealed that their greatest fear was being attacked by B-52s, each dropping 38,250 pounds of conventional, non-precision ordinance. It is especially true for troop formations, but reasonably applicable at all echelons, that the shock,

noise, and disruption of an air attack can have a paralyzing and demoralizing effect out of all proportion to the amount of physical destruction achieved.[13]

Is it Worth the Cost?

A 1998 General Accounting Office study concluded that, ". . . there is a proliferation of guided weapon capabilities and acquisition programs, and oversight of guided weapons requirements and acquisition programs needs improvement."[14] In its 1995 report, the GAO noted that the services had bought or were developing 33 types of PGWs at a cost of $58.6 billion.[15] By 1998, there were projections of $16.6 billion in procurement costs for 158,800 weapons over the succeeding ten years. The services planned to buy four new types of standoff guided weapons to attack fixed targets. These new weapons share very similar capabilities, and are meant to replace weapons in the inventory that are already quite effective against these types of targets.[16] Specializing weapons to achieve tailored effects on different targets is very costly—proliferation of weapon types with similar capabilities leads to low-rate production and increased unit cost for each type. For example, the AGM-130 air-to-ground missile was projected to cost $300,000 a copy at its initial rate of 4,000 units. After being reduced to a run of 711, the unit cost jumped to $832,000.[17] If current projections hold true, by 2010 the Army Tactical Missile System (ATACMS) will constitute .5% of our munitions inventory but account for 28% of the total cost.[18]

Unfortunately, it requires much more than just precise weapons to realize the Precision Engagement concept as envisioned in JV2020. In addition to being able to put ordinance precisely where we want it, Precision Engagement requires that we possess sensors that can precisely locate targets in all weather and light conditions; that our intelligence can

discern critical targets from non-critical ones or decoys; that our command and control system is responsive enough to launch the attacks before the target is moved; that our weapons can acquire and reach targets in dense terrain or buried underground; and that we can accurately assess the results of our strikes in near-real-time. Absent these requisite capabilities, increasing the precision of our weapons results in very little increase in capability.

Sensor technology is much more likely to be the limiting factor in implementing Precision Engagement. Martin Libicki points out, in Illuminating Tomorrow's War, that the advent of precision weapons has changed the nature of conflict from force-on-force to hide-and-seek.[19] Even considering recent advances, state-of-the-art sensor technology still has limitations that give the advantage to the hider. Our space-based sensors operate either in a geosynchronous orbit that provides continuous coverage but low resolution, or in low-earth-orbit, which yields improved resolution but knowable overflight times. Airborne sensors are not stealthy and therefore often forced to operate well outside their optimum ranges. Unmanned Aerial Vehicles (UAVs) potentially solve the distance problem but they can be blinded or shot down.[20] Another lesson from the Kosovo conflict is that as soldiers and their equipment look more civilian, it becomes harder to differentiate between them.[21]

The Persian Gulf War provides a good example of how being able to put ordinance on a precise point does not equate to being able to eliminate an enemy capability. PGWs were not as effective as expected in part because we lacked intelligence on some critical targets and were unable to rapidly collect and disseminate BDA.[22] We destroyed much of what we knew existed of Iraq's nuclear weapons program, but post-war inspections revealed that we only "saw" the tip of the iceberg.

Even with perfect intelligence, the most expensive PGWs can still miss their target. Any high-tech detection/acquisition/targeting system we can devise can be defeated by low-tech (i.e. cheap) countermeasures. Any enemy with an infrastructure worthy of attack will have the wherewithal to bury, hide, or camouflage his high value targets. Those targets that are mobile will be moved, and as we move towards smaller warheads, they won't have to be moved very far to escape the effects of our attack. Our adversaries are very good at using decoys and signature-masking camouflage. They have recently discovered another very effective way of countering our precision capabilities—by playing on our collateral damage aversion and using human shields or locating important targets in areas where we are politically restrained from attacking.

Autonomous PGWs in existence or under development allow us to strike without putting aircrew at risk but rely on sensors that are more susceptible to jamming and spoofing than man-in-the-loop systems. Many of these systems rely on GPS guidance that is particularly susceptible to jamming because of the low power of the satellite signal.[23] Nevertheless, we are currently developing new weapons and converting old ones to use GPS guidance; the Joint Direct Attack Munition (JDAM), Tomahawk, Standoff Land Attack Missile-Expanded Response (SLAM-ER), and Conventional Air-Launched Cruise Missile (CALCM) are all being converted to GPS guidance. Electronic jammers that could be constructed for a few hundred dollars by the average electrical engineering student are capable of jamming current GPS receivers up to 12 miles away with as little as 12 volts of power.[24] Assuming that we add costly anti-jam capability to our new weapons, it would still take only a slight amount of induced drift to cause a weapon to miss its target and produce the collateral damage we are desperately trying to avoid.

Alternative Courses of Action

United States military R&D and operational thinking is apparently sold on the idea that PGWs represent a revolutionary new way of warfare that will afford us continued preeminence in future conflicts. We are developing smaller, more precise weapons that cause "tailored effects" and limit collateral damage as much as possible. We are becoming more casualty averse with each passing operation and are seeking a technological solution to warfare that substitutes calculated degradation of key systems for destruction of people and enemy will. We are becoming more reluctant to deploy ground forces to engage the enemy and occupy territory, and instead seek to fight our battles from afar with standoff and stealth. I believe that the nature of warfare has not changed as much as we would like to think it has and, therefore, propose an alternative course of action.

First, we should move away from our focus on smaller warheads with less explosive power. These weapons have a place in our arsenal to allow attack of politically-sensitive targets in civilian population centers, but such targets represent a very small fraction of the overall target set. Collateral damage in most other scenarios can be a "bonus" because it increases the morale effect of our bombing and results in greater destruction of the enemy's resources. We claim that an advantage of precision weapons is that they can shut down a target without reducing it to rubble, therefore making it easier to repair after the war. We neglect the fact that this also makes it much easier to repair *during* the war. Use of smaller warheads assures that even minute errors in our location calculations or near-misses induced by enemy countermeasures will result in failure to create the desired effects on a target.

Second, we must realize that attempts to further increase precision lead to rapidly diminishing returns. The expensive new weapons being developed can only marginally improve on our already staggering ability to put ordinance within a very small circular error probably (CEP). How precise is enough? If we define accuracy to mean getting a weapon close enough to its target to have the desired effect, then most of the weapons we currently possess, even conventional, unguided bombs, are accurate. Precision implies an increased effort to be exact and is much more difficult and costly to attain, and militarily superfluous in most cases. When mean miss distances are measured in feet and inches, increased precision produces a very small marginal benefit. By the time of the Persian Gulf War, US tactical aircraft were already equipped with weapons delivery software and aiming systems that produced a thirty foot CEP when dropping dumb bombs. When a target requires more precise attack because it is hardened or buried, there are plenty of PGWs already in the inventory available for the task.

Third, if we assume that countermeasures can cause PGWs to miss, it makes sense to acquire a large number of weapons to assure target destruction. But the expense of these systems discourages their acquisition in large quantities and we are developing operational concepts that rely on reduced munition expenditure. The Navy's Operational Maneuver From the Sea construct counts on the ability of precision weapons to produce greater effect with fewer rounds. This translates into additional shipping space, reductions in overland transport and on-shore storage, and reduction in the time needed for ship-to-objective and ship-to-shore maneuver.[25] It may be the case, however, that more and larger weapons are more effective counters to enemy countermeasures.

Instead of developing a plethora of different weapon types with tailored effects, we should be acquiring a small family of versatile weapons that can be produced in mass quantities.

Our development efforts should focus on weapons that are (1) cheap, (2) easily adaptable to different delivery vehicles and platforms, (3) reliable, and (4) accurate (not necessarily "precise"). "Tailored effects" weapons are part of a fallacy that assumes that we can conduct warfare in a "sterile" environment; the reality is that destruction is still the best effect for most targets. Further, the assumptions that "one bomb equals one target" and "the bomb will always get through" are woefully optimistic in the face of an adaptive enemy possessing cheap countermeasures. They lead us to the further dangerous assumption that we can get by with less and smaller bombs, less aircraft and other delivery vehicles, and ultimately less lift capability. Since lift is perhaps our greatest shortfall, it is tempting to believe that we have found a way to, again, do more with less. Unfortunately, we will need to address this problem with real dollars, and not blind faith that a few precision weapons will win the day.

Fourth, we must guard against "mirror-imaging" when considering our future opponents. In fact, our potential adversaries are looking less and less like the United States. Robert Scales points out that the Cold War impulse of non-Western states to clone Western forces is disappearing. They are eschewing sophisticated aircraft and blue water navies and focusing instead on cheap weapons of mass destruction (WMD) and methods of delivering them. They are learning to disperse, hide, or even eliminate vulnerable logistics, transportation, and telecommunications facilities.[26] Since they don't rely on such systems to nearly the extent that we do, loss of such systems may not result in climactic failure or loss of will. Future conflicts are likely to be with terrorist organizations or subversive elements within a state that may not even have an identifiable infrastructure to target. Even against a relatively industrialized enemy, we may lack the political will to take down their critical nodes due to target location or adverse effects on noncombatants.

With this in mind, we must reexamine the mix between more expensive autonomous weapons and cheaper, more flexible man-in-the-loop systems. Missiles and long-range standoff weapons with hard-target kill capability are required to attack heavily-defended, hardened, point, strategic targets. When such targets exist, they are not amenable to close-in attack by aircraft because of the risk involved. Nevertheless, these targets may be the exception in a war against less technologically oriented foes. Out development efforts should be weighted towards aircraft-delivered weapons that capitalize on the flexibility of man-in-the-loop systems to locate and destroy mobile or re-locatable targets more cheaply. Further, since manned aircraft will remain for some time the only reliable tool for attacking such targets, we must continue to ensure the viability of this option. We face critical shortfalls of jamming, refueling, and airborne control aircraft and require new platforms for each of these missions if we are to retain our ability to conduct a conventional air campaign.

Fifth, we must reassess our perceived obligation to reduce collateral damage to an improbably low amount. Our obsession with minimizing collateral damage drives our development efforts towards increased precision and smaller weapons. These weapons make it politically palatable to attack targets in populated areas that would otherwise be off limits. However, the threshold of acceptable collateral damage has been consistently lowered over the last few conflicts, thanks to the prominent media coverage afforded to each unintended death. We apparently will not be satisfied until we develop the ability to destroy a particular computer on a particular desk without harming anyone who may be in an adjacent office. We are not morally obligated, nor is it militarily expedient, to expend tremendously expensive weapons to ensure the safety of an enemy who plans to attack us with unguided missiles and indiscriminant

WMD. When we provide so much sanctuary to our opponent, we reduce our ability to influence both his will and capacity to fight.

Sixth, we must be prepared, both psychologically as a nation and militarily, to deploy to a trouble spot and put troops in harm's way. Precision attacks with standoff weapons do not show commitment; it is possible that they send the exact opposite message. Attempts to solve conflicts with a limited number of risk-free strikes may not placate our allies or intimidate rogues. A recent study touting the ability of a U.S. force with dominant battlespace knowledge to stop an Iraqi advance into Kuwait without augmenting the in-theater forces showed that it indeed could be done. It would require, however, the launching of between 10,000 and 20,000 autonomous weapons. I'm not sure we can afford this type of "cheap" defense.

Seventh, our operational vision of future war should turn away from the single offensive dimension of precision firepower. Our real strengths lie in our mobility and the synergy of our joint forces. There are certainly situations in which airpower alone can "halt" an enemy advance or deter undesirable behavior. Against a determined foe, however, a credible ground threat will be required to defeat his will. The public, the media, and our military leadership must be taught to understand that war has not changed so fundamentally over the last two decades as to become a risk-free video game. It still does, and always will, involve hard choices, sacrifice, and horrible death and destruction.

We still have not figured out how to maneuver the components of a joint force as an integrated whole to present an enemy with diverse, asymmetric threats throughout the entire area of operations that overwhelm his ability to react. Instead, we continue to divide an operating area into component areas of responsibility and attempt to "coordinate" actions as much as

possible. Development of communications and operational concepts that allow us to truly integrate the components will provide the real "revolution" that ensures our dominance. We should pin our hopes and efforts here rather than on the single technological capability to guide weapons to a desired point on the earth.

Conclusion

Precision guided weapons do not represent a revolution in military affairs and will not ensure U.S. dominance in future conflicts. They are merely an evolution in firepower that has temporarily increased its ability to affect the battlefield. Countermeasures already exist and will continue to improve. Adaptive enemies will use maneuver, combined with spoofing, camouflage, concealment, hardening, burial, self-defense, and our aversion to collateral damage to mitigate our technological advantage. If we focus too much of our resources and thinking on the single offensive dimension of firepower, we will be impotent to influence the will of an enemy who can insulate himself from its effects.

We are spending a large proportion of a tight budget on developing smaller, smarter, more precise weapons that can be defeated cheaply. Our operational concepts are coming to rely on our current technological advantages to the point that we may forget how to fight without them. We are becoming more averse to casualties, both friendly and enemy, while we strive to make war into a risk free, sterile exercise of systems analysis and metered force. This will rapidly become our Achilles' heel if we fail to recognize that warfare, sadly, has not really been transformed.

Destruction remains the most militarily expedient effect we can have on most targets. Large, accurate weapons currently in the inventory have the ability to destroy the majority of

these. More precise weapons will always be necessary to attack heavily-defended or hardened targets, or those located in politically sensitive areas where collateral damage would be detrimental to our cause. However, no matter how precise our weapons become, enemy countermeasures, and the inevitable fog of war, will ensure that the "one bomb, one target" paradigm will never be achieved. We will continue to need a large number of cheap, reliable, versatile, and accurate weapons to defeat a determined enemy.

Our decisive advantage in future conflicts will derive from our ability to combine the firepower and maneuver of all the components of our joint force into a coherent whole. The communication and sensor technology that underlies the precision engagement concept will allow this to occur. Putting precision weapons themselves at the center of our emphasis results in too much focus on the single dimension of firepower, and is counterproductive. The Army sums it up well in their 2010 vision statement: "For land forces, shaping the battlespace is far more than precision strike which, as a lone function, is nothing more than 21st Century attrition warfare."[27]

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