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THE IMPACT OF EMERGING MUNITIONS TECHNOLOGY ON 21ST CENTURY WARFARE

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Over the last decade the American public has been exposed to countless media reports of surgical strikes carried out by precision munitions. With each new gun camera clip the public is reminded that America's armed forces possess an unparalleled ability to discriminately strike hostile targets anywhere in the world with virtual impunity. While some herald this as the true fulfillment of the prophecy of airpower, I believe that it has greater ramifications. Far from signaling the ascendancy of airpower, it instead the heralds the death knell of 20th century warfare as advanced munitions gain primacy over the platforms that deliver them. This shift to munitions primacy signals the start of a new era in the character and conduct of war as we enter the 21st century.

To fully understand the implications of the dawn of this new era of warfare we must trace the evolutionary process that has taken place during the last century. At the turn of the 20th century, military theorists and strategists were primarily challenged with responding to technological innovations that, while impacting directly on the tactical level of warfare, translated into operational and strategic implications. The breech loading rifle, smokeless powder, and magazine fed weapons magnified the historical advantage of the defender. Faced without a technological solution to this new killing power, soldiers responded by abandoning close order formations and dispersing on the battlefield. The net result of the impact of the technological advances in small arms was the loss of the ability to inflict enough casualties to gain a decisive

victory in a single engagement.[1] The decisive engagement was replaced by the operational campaign as the means necessary to inflict enough losses to defeat an enemy army and gain strategic victory.

Advances in artillery technology soon complimented the technological advances in small arms. In the first decade of this century, artillery evolved from a direct fire weapon into an indirect fire system that added tactical depth to the battlefield. In World War I artillery emerged as the dominant tactical battlefield system. However, limitations in range, mobility, and communications prevented commanders from translating the tactical advantage of artillery into operational and strategic success Efforts to turn artillery into an operational and strategic weapon were limited by the technology of the day. For example, the attempt by the Germans to use artillery as a strategic weapon aimed at breaking the will of the French populace resulted in the development of the Paris Gun. This gun could fire a conventional artillery projectile 70 miles, but with little accuracy, a puny payload, and with an extremely short system life.[2] The enhanced tactical killing power of artillery and small arms was offset by the ability of industrial age nations to mobilize all their elements of power to produce large field armies capable of sustaining large numbers of casualties.

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[1] Military analyst Trevor Dupuy demonstrates that as weapons have increased in lethality daily, causality rates have decreased as a result of increased dispersion In antiquity a force of 100,000 men would typically occupy an area of 1 square kilometer By World War I this area had increased to 248 square kilometers and in World War II 2,750 square kilometers Trevor N Dupuy, Attrition Forecasting Battle Casualties and Equipment Losses in Modern War (Fairfax, VA Hero Books 1990) 25-29

[2] The German Paris Gun had an overall barrel length of 112 feet and weighed 138 tons It was capable of achieving ranges up to 70 miles but its payload was only 15 pounds of explosive and the gun had to be rebored after only 65 firings Trenches on the Web 'Big Guns of the Great War' available from http://worldwar1 com/pharc005 htm accessed on 23 April 1999

The increased scope of industrial age warfare led theorists to seek new methods for attacking the full depth of an enemy's war-making structure. Since artillery had reached its technological limits, new platforms were required to deliver munitions to the expanded battlefield. Technological advances in aviation appeared to provide a solution. As aviation technology matured, aircraft became capable of carrying increasingly heavier loads of ordnance and delivering them over longer ranges with increasing accuracy. In a period of approximately 30 years combat aircraft advanced from pilots dropping single grenade sized bombs by hand to aircraft capable of delivering tons of ordnance over thousands of miles.[3]

While these technological advances in platforms were impressive, the end result remained little changed from World War I. Technology was concentrated on improving platforms capable of delivering high explosive munitions. While platform advances added depth and simultaneity to the battlefield, the munitions they delivered were still relatively crude high explosive devices that depended on volume to achieve the desired level of destruction Pictures of bombed out cities of World War II differed little from pictures of battlefield destruction in World War I Destruction was still measured in tonnage of ammunition expended The munition of choice remained high explosives, although aircraft had supplanted artillery as the delivery platform of choice.

[3] By 1945 the B-29 Superfortress was capable of delivering a 20 000lb bomb load over 5,830 miles Boeing Corporation, B-29 Superfortress A Brief History available from http www boeing com company offices history boeing b29 html accessed on 23 April 1999

The first sign of a shift in the primacy of platforms over munitions came in the middle of the Vietnam War. On the ground, artillery delivered Improved Conventional Munitions (ICM) that improved lethality by dispensing anti-personnel submunitions, vice simply a high explosive charge, supplemented standard high explosive munitions. The volume of fire required to defeat a target was substantially reduced with this new munition. In the air, along with submunitions, a more dramatic change took place with the introduction of first generation guided munitions. Again, the end result was a dramatic reduction in the volume of munitions required to destroy a given target.

These developments in surface-to-surface and air-to-ground munitions continued to evolve after Vietnam. The variety of submuntions expanded to include anti-material and area denial submunitions in addition to anti-personnel submunitions Precision delivery of air-to-ground weapons provided for both laser and visual guidance. The first generation of surface and air launched cruise missiles made their debut and provided a long range, survivable means of target attack As a result the United States entered the Gulf War with a significantly enhanced ability to accurately and lethally attack targets throughout the depth of the battlefield [4]

Despite these impressive advances, the paradigm remained essentially unchanged. Aerial platforms remained the platform of choice for delivering

[4] The dramatic impact of precision weapons is demonstrated by the comparison of World War II bombers to contemporary weapons systems Today 2 F-177s dropping 4 precision weapons can achieve the same effect as 300 World War II B-17 bombers dropping 3 000 bombs Buster C Glosson Impact of Precision Weapons on Air Combat Operations," *Airpower Journal*, 7, no 2 (1993) 1 Electronic journal online

munitions over operational and strategic distances. Relatively unnoticed in the deluge of publicity surrounding the nightly gun camera footage of precision aerial strikes was the debut of the Army Tactical Missile System (ATACMS) launched from the Multiple Launch Rocket System (MLRS). The ATACMS represented the first surface based system that would truly break the primacy of the aircraft as the platform of choice by combining range, lethality, and survivability on a scale unapproachable by manned aircraft and cruise missiles.

The earliest version of ATACMS employed in the Gulf War provided the joint force commander with the first ground based system capable of matching the lethality of aerial delivered weapons at operational ranges. The 165 km range of the Block I ATACMS gave the ground commander the ability to directly attack to operational depths with impunity. The ATACMS delivered the same submunition available from aerial delivered munitions but with less cost and enhanced responsiveness. The sensor to shooter to target cycle was lowered to minutes. Gone were the needs for the ponderous 72 hour Air Tasking Order (ATO) cycle, the methodical requirement to roll back enemy air defenses, and the fear of loss of costly airframes and pilots to enemy action. Lost in the euphoria of the "Air Campaign" was the fact that manned aircraft had reached their zenith as the platform of choice for operational attack.

The evolving shift from the manned aerial platform paradigm has been demonstrated in the years following the Gulf War Strikes against Iraq, the

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available from http://www.airpower.maxwell.af.mil/airchronicles/apj/glosson.html accessed on 20 April 1999

terrorist Osama bin Laden, and most recently in Kosovo have relied on cruise missiles as the initial munition of choice. Yet despite their rising importance, cruise missiles are handicapped in the sheer volume of damage they can deliver. More dramatic and less publicized have been the technological advances in other surface based systems that will allow the trend towards surface based systems to continue When these advances in surface platform technology are combined with advances in munitions, the fundamental character and conduct of war promises to change.

On the ground, the ATACMS has continued to enhance its range, accuracy, and lethality. The 165 km range of the Block I missile has been upgraded to 300 km with the introduction of the Block IA missile and in FY 2004 the range will extend to 500 km with the introduction of the Block IB missile.[5] While currently still an area weapon, the planned introduction of GPS guidance will give the system the capability of precision attack. While these advances are impressive they pale in comparison to the advances in lethality that the new family of submunitions will add to the battlefield

The current anti-personnel/material submunitions will be complimented by the addition of sensor fused munitions. Current plans call for the deployment of the brilliant munition (BAT) in FY 2001. BAT uses a tri-sensor package combining acoustic, infrared, and millimeter wave technology with free flight. This technology allows BAT to locate and attack hot or cold, stationary or

[5] John K Yager and Jeffrey L Froysland, "Improving the Effects of Fires with Precision Munitions *Field Artillery* 2 No 2 (1997) 7

moving, soft or hard vehicle targets in a large radius from its dispersal point. Along with BAT, other submunition developments underway include enhanced capabilities to search large areas with improved target detection and recognition.[6] As these enhancements are fielded, ground forces will possess an unprecedented ability to conduct deep and simultaneous attack. Had these enhancements been available in the Gulf War, an ATACMS launcher with its three-man crew would have been able to directly attack the Iraqi operational center of gravity, the Republican Guard, from initial positions in Saudi Arabia.

These impressive capabilities will be further maximized when fused with platforms that offer strategic reach. The Navy's move toward enhancing its littoral warfare capabilities has resulted in several ongoing efforts to leverage Army technology for use at sea. Naval developments include the Extended Range Guided Munition (ERGM) that will boost the range of naval gunfire from 26 km to 117 km with greater accuracy and lethality. Ongoing research promises to extend the range of the naval gunfire system to 465 km with the introduction of the Vertical Launch Gun System.[7] In addition, efforts to "navalize" the ATACMS or develop ship-based systems with similar capabilities are underway. As these technologies are fielded and mature, they will allow a Joint Force Commander the ability to conduct strategic and operational movement and engage hostile targets throughout the tactical-operational-

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[6] Ibid

[7] Jane s Information Group TI to Develop EX-171 ERGM," *Jane s Navy International* 101 No 9 (1996) 8

strategic spectrum at standoff ranges When mated with the inherent stealth of submersible platforms, they will also provide a dramatic increase in survivability.

In 1993 Air Force Lieutenant General Buster Glosson described the impact of precision weapons on future war. Glosson viewed precision weapons as maximizing combat capability by permitting the U.S. to hold any target at risk while simultaneously minimizing the risk to U.S. lives To make this a reality, Glosson saw the highest priority as developing weapons that could attack moving and stationary targets in all weather.[8] While aerial delivered weapons have made impressive gains with the addition of the Joint Standoff Weapon (JSOW) and the Joint Direct Attack Munition (JDAM) they still suffer from one flaw, they are delivered from aerial platforms that can be held at risk by enemy defensive systems. Glosson proved shortsighted when he stated that "precision warfare is not possible without first controlling the air."[9] Today's surface based systems have no known countermeasures and any attempt to develop defensive countermeasures will require a quantum leap in any current technology. The difficulty the U.S. has faced in countering crude Iraqi SCUD missiles in the Gulf War and continuing efforts in developing a ballistic missile defense capability bear witness to the difficulty countering long-range surface-to-surface systems

As exciting as these technological developments may promise to be, their full potential will only be felt if they change the context within which war takes place. Great Britain's air defense developments in World War II provide an

[8] Glosson ' Impact of Precision Weapons on Air Combat Operations,' 1-2
[9] Ibid 2

example of translating technological changes to alter the context of war. By utilizing advances in fighter aircraft and radar, Britain's Fighter Command was able to alter the accepted paradigm of the dominance of offensive attack and create a new context that the German Luftwaffe was incapable of adapting to despite possessing superior equipment and tactics.[10]

To fully leverage the coming advantages that advanced munitions will offer, the U.S. must avoid the tendency to discard history or twist its lessons to justify current doctrine and beliefs [11] The easy solution is to simply look at advanced munitions as a natural evolution that will allow current doctrine to be applied more efficiently. Airpower enthusiasts will tend to look at advanced munitions as an evolutionary advance in current capabilities and continue to seek sophisticated high cost platforms as the deliver means. As a result, war will continue to be fought on the methodical model with the quest for air superiority maintaining a dogmatic position.

The danger of continuing to follow an accepted paradigm and ignoring evidence that suggests dramatic change is illustrated by the Japanese World War II failure in submarine warfare. Equipped with the most technologically advanced undersea weapon of the war, the Long Lance torpedo, the Japanese failed to glean the lessons from World War I and the observable evidence of the ongoing Battle of the Atlantic of the importance of attacking and protecting commerce. As a result, they expended little resources on protecting their sea

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[10] Williamson Murray Innovation Past and Future," in Military Innovation in the Interwar Period ed Williamson Murray and Allan R Millet (New York Cambridge University Press, 1996) 305-306

lines of communications or interdicting allied commerce. By failing to adapt technology to the new context of war, they lost virtually their entire merchant fleet while hardly inflicting any damage on their opponents shipping.[12]

How can we mirror the British example and avoid a failure such as the Japanese suffered? Figure 1 outlines the character and conduct of the Gulf War described during Course 5602 and proposes how the advances in munitions technology can be leveraged to impact on the context of 21st century warfare. The future conduct of the "American Way of War" promises to rely on CONUS based power projection forces, utilizing space based or long loitering unmanned reconnaissance systems linked directly to standoff weapons systems launched from relatively inexpensive and unsophisticated platforms These systems will allow U.S. forces to engage targets rapidly, accurately, and lethally with relative impunity from international waters or airspace. Operating from sea bases or long distance, friendly force protection will be enhanced by eliminating the requirement for building up forces on fixed land bases susceptible to attack by conventional forces or weapons of mass destruction

The coming change in the character and conduct of war will have dramatic ramifications for each branch of the service. For the Army and Marine Corps, 21st century warfare represents a shift in the long accepted relationship between fire and maneuver. The traditional subordination of fires as a

[11] Ibid 320
[12] Ibid , 321-322

supporting element to maneuver forces will be reversed. The Air Force, Navy, and Marine Corps that have each invested large amounts of money, personnel,

PERIOD	CHARACTER OF WAR	CONDUCT OF WAR
Gulf War	-limited war by both sides -military retains control of operations -technological edge -sensitivity to coalition -desert environment -ability and intentions to limit damage	-use of strategic air power, precision attacks in Iraq -extended air operations prior to ground attack -joint/coalition attacks -ground maneuver operations -single ground battle of annihilation
Emerging 21st Century Warfare	-Aversion to friendly casualties -CONUS based, power projection forces -joint/coalition action -limited objectives -asymmetric response	-Use of stand-off weapons -Relatively simple platforms delivering sophisticated munitions -Space based/long loiter recon platforms -Direct sensor to shooter link -Simultaneous attack throughout depth of enemy -Primacy of fires over maneuver

Figure 1., Character and Conduct of War

and training on sophisticated delivery platforms must recognize that the paradigm has changed. The power and primacy of the Air Force's fighter community, the Navy's carrier based air, and the Marine Corps' aviation component will all be challenged. Resistance to change within each of the services is bound to occur. As witnessed in history, Battleship Admirals and Horse Cavalry Generals held sway in their respective services long after the primacy of their systems had passed.

The U.S must remain cognizant of the fact that we do not possess a monopoly on innovation The French and Germans shared a common experience during World War I, yet only the Germans learned and applied the

correct lessons of that conflict. Emerging munitions technology presents us with an opportunity to move away from the paradigm of platform primacy. The danger in avoiding the opportunity that this new technology presents rests in the fact that a future opponent may seize the opportunity first. We must decide if we will be the France or Germany of the next war.