# Combat in the Information Age: Adjusting Ground Combat Formations for Future War

**Abstract**

The global availability of information, materials, and high-technology products that characterize the Information Age has begun to significantly affect ground combat. As a result, new requirements and technological integration challenges are creating "task overload" for American ground combat units, whose organizational structures are optimized for the last war. The US Army and Marine Corps should therefore adjust policies for manning, training, and leadership to establish better manpower resources that will facilitate reorganization of ground combat units capable of winning the deep, highly complex engagements that will characterize Information Age warfare.

**Subject Terms**

Manpower, small unit leaders, ground tactics, techniques and procedures (TTPs), Information Age technology, knowledge management, innovation, organizational networks, career development.
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FUTURE WAR PAPER

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Combat in the Information Age: Adjusting Ground Command Formations for Future War

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PART 1: THE CHALLENGE OF COMBAT IN THE INFORMATION AGE

New Technologies Have Changed the Character of War

During long periods of relative peace between major wars, civilization progresses. Economic interaction, rather than the needs of military armament, is the major driver of innovation. Over time, technological developments may be such that they result in a great change in how society conducts and orders itself. Military leaders must seek to understand how the new technologies that dominate social and economic interaction will affect the conduct of the next great war. Academic debate aside, only the test of battle can reveal which new weapons and tactics will contribute to victory against a thinking enemy. Small and limited wars during such periods, therefore, shed valuable light on emerging technologies that may significantly change combat, although they cannot fully reveal the extent and cumulative impact of changes that would occur in a future war involving total mobilization of the industrial base of advanced nations.

A major change in society occurred in the late twentieth century as the world moved from the Industrial to the Information Age. This new era is characterized by global availability of information, materials, and high-technology products. As early limited conflicts in this new era,
the wars in Afghanistan and Iraq provide insight into how these changing characteristics of world society affect ground combat.

The U.S Army and Marine Corps fought those wars with combat units whose small unit organizational structure had changed little since World War II. Confronted with a variety of new battlefield threats, the ground services attempted to adapt by assigning new equipment and new training requirements to their existing combat formations. This approach often resulted in task overload, sapping the time and energy of talented combat leaders who also needed to focus on taking the initiative against a thinking enemy. American ground forces were in fact only able to employ many of their technological responses to the threats of modern combat by using civilian contractors to an unprecedented extent in a warzone.

It is likely that “task overload” and technological integration challenges will be even more significant by the next war. Future adversaries can be expected to use any and all technological innovations with military potential that Information Age economies can produce. Multi-technology products and systems, particular those that use the electromagnetic spectrum, computers, and advanced micro-materials applications, will become ever more globally available. It is time, then, to stop simply piling new requirements on ground units whose personnel and organizational structure are optimized for the last war. Army and Marine Corps leaders should instead adjust policies for manning, training, and leadership to establish improved manpower resources that will enable reorganization of ground combat units to win the deep, highly complex engagements that will characterize Information Age warfare.

Examination of the lessons learned from recent wars, the specific features of potential future battlefield technologies, and the characteristics of other institutions that have grappled with the problem of transition from the Industrial to the Information Age, provides insight on
desirable characteristics for modern ground forces. Synthesizing these lessons, the Army and Marine Corps should consider three steps that would serve as a foundational platform to facilitate reorganization of ground unit structures:

(1) Create a new class of limited duty officer (LDO) to help recruit individual technology specialists for ground combat units.

(2) Institutionalize “tactical innovation centers” within ground combat units.

(3) Revise manpower policies to increase the expertise of small unit leaders and promote informal networks of knowledge and innovation in the ground force.

Future War Will Be Complex and Multi-dimensional

The Damocles Sword of nuclear weapons and other weapons of mass destruction hangs over the head of modern civilization. Continuing the trend of the second half of the twentieth century, American military leaders and leaders of significant near-peer competitors will be expected by their political superiors to use the utmost skill to avoid the acceleration of violence in future wars into something unthinkable. Other potential enemies, due to industrial and economic weakness, will also employ strategies that avoid an escalating competition with U.S forces based primarily on massed firepower. It is probable therefore, that America’s future wars will begin with political restrictions aimed at keeping the conflict to a level short of total war.

Belligerents will attempt to shape the combat environment by obtaining dominance in the global commons – to include space, cyberspace, and the electromagnetic spectrum in addition to sea and air. Such dominance may be total or local, and its duration may be temporary or enduring. For the US, Navy and Air Force units, Cyber Command, and other national agencies will have the lead in setting these conditions. At some point, ground forces will be inserted to complete the defeat or destruction of the enemy and/or gain control of terrain, individuals or
population centers that will produce military end state conditions suitable to enforce peace on desirable terms.

If an enemy seeks to directly confront American forces in conventional combat, the primary means to apply firepower en masse to destroy equipment and personnel remains artillery and combat aviation, while infantry with armored vehicles and tanks maneuver to obtain positional advantage and exploit the destructive effects of these fires. But in an era of immense population growth and urbanization, with ever-increasing social and economic interaction in the cyber and electromagnetic commons, America's adversaries will be less likely to attempt maneuvers that involve concentrating forces, and more likely to engage with remote controlled systems, using populated areas as a buffer against US firepower dominance. Air, space, and naval platforms will not be able to engage with the required finesse. American ground units will be required to combat emerging multi-technology threats while operating in environments where close combat conditions and population effects dominate.

**Ground Forces Need New Capabilities for Future War**

During the twentieth century and continuing to the present, American air and naval forces have been the military branches most concerned with the technological sophistication of their platforms. Air and naval superiority are fundamental to the American way of war. In American combined arms doctrine, ground forces conduct forcible entry only after local dominance in the maritime and air domains is attained, and ground units expect to rely on supporting effects from air for most operations. The assumption that American air forces will successfully obtain air dominance has shielded the ground services from recognizing a compelling need to innovate with
certain new types of technology – weapons and defensive systems operating in the electromagnetic spectrum, for example.²

In Iraq and Afghanistan, however, America’s enemies found ways to negate some of the effects of American air dominance by harnessing an old weapon – the booby trap or mine – with Information Age technologies and materials. Using a variety of techniques, they were able to achieve effects remotely, operating out of range of U.S weapons systems or in civilian areas where non-combatants would suffer from a robust U.S. response.³ The institutional reaction of the American military was to throw new equipment into the fight to defeat these threats. This reaction can be summarized by the data in Tables 1 and 2, showing the equipment employed by American ground combat units in 2001 and 2012, respectively. Figure 1 illustrates the ever-increasing complexity of a ground unit’s battlespace by 2012.⁴ For small unit ground leaders, the number of systems they were expected to manage and successfully employ almost doubled; and tactics now had to account not only for ground and air weapons, but also for invisible “bubbles” of electronic warfare effects.

The changes within American ground combat units that occurred in Iraq and Afghanistan as evidenced by Tables 1 and 2 should be of utmost interest to military leaders, because they evolved through inductive responses to the empirical data of actual combat.⁵ The experience of these wars demonstrated the potential for modern belligerents to create battlefield effects that were not easily overcome by the standard equipment/systems in the military arsenal. Military leaders who dismiss these lessons as isolated features of counterinsurgency are missing the broader implication of the changes, just as European military experts in the years preceding World War I did not appreciate technological and other developments that occurred in what they considered remote wars against second-rate powers.⁶
But other technological developments beyond those evident in Iraq and Afghanistan must also be taken into consideration in the design of a future ground force. A global cat and mouse game is currently underway, involving the most advanced state of the art military technology, between potential adversaries manufacturing new anti-air systems and U.S aircraft development. Defense procurement instigated by this strategic posturing threatens to raise the costs required to gain U.S. air superiority to levels that are much harder to sustain, meaning that fewer air support platforms may be available in direct support of ground forces in future war.7

A lesson can be drawn from military history that often an extreme escalation with one type of military weapon/armament is negated by tactical innovation in a different area. In Iraq and Afghanistan, enemy light forces were able to seriously impede U.S. forces despite U.S. air superiority. Although American responses might have been more violent in a conventional fight, a more powerful adversary would also have been able to employ additional anti-access capabilities that were unavailable to Afghan or Iraqi insurgents.8 To help the U.S. military remain a competitive combined arms force, therefore, American ground forces should seek to employ more remote controlled combat systems (both offensive and defensive) to augment air-delivered effects and to mitigate reduced in close air support capacity in a contested environment.9 Ground robots and small un-manned aerial vehicles (UAVs), for example, may soon be able to execute reconnaissance and fire support functions that were previously conducted by manned aircraft and ground personnel. Defensive systems against enemy air and electromagnetic-controlled weapons are already being employed by ground units, and this function will become more important in the future.
A Foundational Platform

In the Information Age, the ground force that can adapt to unfolding circumstances, innovate with a variety of systems, and obtain the greatest effects with emergent technologies will have a decided advantage in war. Table 3 lists technologies and potential new weapons systems and equipment that future ground combat units may need to employ. America’s ground forces of the future must be structured and manned to operate multiple types of high-technology equipment. They must be able to spot opportunities and speedily bring to the fight new technologies as they emerge in global industry, rather than solely relying on lengthy research and development (R&D) and procurement processes within the military establishment.

Changes to recruiting and manpower policies could enable restructuring of U.S. ground forces to better operate with high tempo in such a complex environment. However, because existing dominant systems for massing firepower (tanks, machine guns, airpower, etc.) are still relevant, and because immutable aspects of the nature of war have helped shape current force structure, the changes should be graduated and evolutionary, not revolutionary.

The new force must begin by retaining vital characteristics of the old. Specifically, new Information Age technologies have not changed a critical feature of ground combat:

Characterized by extreme violence and physiological shock, close combat ... stresses every aspect of the physical, mental, and spiritual features of the human dimension...[and] places the highest value on individual discipline, personal initiative, and performance-oriented leadership.\(^\text{10}\)

Policies for a future ground force must therefore continue to produce leaders and personnel with these characteristics. Training must remain physically and mentally tough, and team skills must
be reinforced by constant repetition. A force that is recruited young and trained vigorously, like the U.S. Marine Corps, has been proven to excel in the environment of close combat.\textsuperscript{11}

On the other hand, review of literature on successful business adaption to Information Age technologies highlights other characteristics that ground forces will need for future wars. First, the workforces of successful Information-Age organizations are much more highly educated than Industrial-Age workforces. Second, high-technology enterprises generally require more individual specialization within their workforce. Third, successful organizations thrive on leadership and management practices that produce "learning organizations" that synergize the talents of individuals in the organization, resulting in constant innovation and effective distribution of expertise across the organization.\textsuperscript{12} Undoubtedly, a ground combat force that can adopt these characteristics will gain an edge in its ability to employ sophisticated technologies against future adversaries.\textsuperscript{13}

It can be argued that American ground forces are already learning organizations to some extent\textsuperscript{14}, but in an age of rapid sharing of information, combat will require even more adaptive organizations. To further improve American military forces as learning organizations, several factors are critical. One is that there must be a sufficient number of individuals at all levels within the service that self identify as "champions of learning."\textsuperscript{15} Another is that individual specialization, beyond mere occupational specialty, must be allowed to occur so that specific champions of different ideas can "incubate their concepts until they are either discarded or become mature enough to introduce to the rest of the organization."\textsuperscript{16} Finally, military organizations should foster personnel networks — formal and informal — to serve as a cross-organizational "locus of innovation."\textsuperscript{17} And they should do this in part by creating enough
“slack” in the careers of key leaders to allow them to pursue individual learning and collaborate with others within the network.

Synergizing a force that contains both highly educated and specialized personnel who can improve the learning and adaptive abilities of ground formations with the warrior ethos, esprit and flexibility that come with youth, generalization, and hard training will require careful management of manpower policies, training, and unit organization.

Step 1: Bring the Right People Into Force: A Technical LDO Program

Ground formations will need to retain most of their current structure for employing traditional weapons, but must also carve out or add new structure for high technology equipment systems such as robots and UAVs. Because of their sophistication, these new capabilities must be supported by highly educated maintainers and operators who can work closely with and amongst infantrymen. In Iraq and Afghanistan, procurement efforts for technical solutions to tactical problems invariably involved bringing contracted specialists into the theater of operations as maintainers, and sometimes as operators. Military personnel received incidental training for much of the equipment (see again Table 2) and were expected to operate it and develop tactics for employment. This was a primary cause of the task overload that troubled ground units on the front lines. Moreover, lack of truly in-depth proficiency resulted in many systems never being employed to their maximum capabilities.\(^\text{18}\) In high intensity war, contractors would not be able to be present on the front lines. There is thus a need to build capacity in the military force with in-depth technical expertise.

Creating new enlisted specialists and selecting personnel for re-training on new equipment systems is not the answer. Individuals who enlist in the military may not have the
right skill sets, even if a screening program was used to find the best candidates and send them to appropriate schools. Furthermore, the process of establishing military occupational specialty (MOS) schools is slow and bureaucratic, and the time spent training recruits in complex technical skills would consume a large part of an enlistment. The constantly changing character of war will likely result in situations where the need for the skills being learned by the selected candidates has been superseded by different requirements before trained personnel ever make it back to the operating forces.

A better solution is to recruit candidates from the civilian sector for specific technical skills that they have already acquired. A present, there are only two ways to enter the military — as an enlistee, with a promise that the military will provide training required for a specific military job, or as an officer, with broad and far-ranging responsibility for planning and conducting military operations. The character of Information Age economies and modern warfare present conditions that suggest benefit in offering a third method for applicants to enter the military: a recruiting program for trained technical specialists, either from industry or academia, to serve as limited duty officers (LDOs) on short-term (3-4 year) commitments. There is an untapped pool in modern society of people who may not desire or qualify for the weighty responsibilities of unrestricted officership, yet have valuable skills that would not be easily exploited should they enlist. Even among the intellectually-oriented communities of the high technology academic/industrial fields, there are men and women with a thirst for adventure and desire to serve a greater cause. If selected specialists were offered short-term military contracts as LDOs at appropriate pay-grades and with appropriate financial incentives, the military could recruit these skilled people.
Recruitment of skilled specialists is not proposed as a standard solution for all new equipment, of course. If the impact vis-à-vis other combat responsibilities is small, some new capabilities could be logistically supported by contractors and operated by Marines and soldiers as collateral duties. However, for the more complex systems - robotics, directed energy systems, complicated electronic support equipment – a Technical LDO (TLDO) program should be instituted. TLDOs, recruited for specific existing skills, would already by trained in their technical specialty by American industry and academia. They could be initiated into the military using a model similar to current programs for doctors, nurses, and other medical specialists. While in some cases there might still be a requirement for MOS training after commissioning, training time would be minimal, and the TLDOs could be swiftly assigned to the operating force in units such as communications, intelligence, engineer, and infantry battalions. They could then be integrated within combat formations, unlike the contractors who were employed in Iraq and Afghanistan. At the completion of their commitment, they would be released from military service or offered extensions and promotions if their expertise remained useful for the military.

Step 2: Institutionalize “Tactical Innovation Centers” Within Ground Combat Units

To achieve combined arms proficiency with new high tech capabilities in support of ground tactical actions requires added training and readiness (T&R) team qualifications, which would result in longer training cycles to build combat-effective units. TLDOs assigned within combat formations would help reduce the need to send other Marines to collateral-duty courses. To further improve small unit effectiveness and enhance the ability of leaders to bring the capabilities of the TLDOs and emergent technological solutions to bear in combat, better organizational mechanisms should be developed within ground combat formations.
In ground combat of the Information Age, it is not enough to have just one advisor to a commander officer at the battalion level with undiluted focus on equipment and tactics (the Battalion Gunner). Lessons from Iraq and Afghanistan suggest that highly experienced experts with differing backgrounds, who focus on synthesizing complex systems and tactics, should be distributed throughout combat units. Moreover, the need for constant training and innovation, even during combat, suggests value in institutionalizing designated organizations in active combat formations to serve as centers of innovation and knowledge distribution.

The Marine Corps already has organizations that could serve as the building blocks for such a program. At each Marine division, there is a Division Schools section that provides training in specific skills that are considered beyond individual unit capacity to self-train but are not taught in service-funded formal schools. Current these organizations are not formally recognized in official manpower policies. They should be formalized as Tactical Innovation Centers and expanded to become robust centers of tactical expertise within ground combat formations.

To excel in Information Age warfare, every combat arms division should operate a Tactical Innovation Center. Similar if slightly smaller Centers could be established at the group-level in logistics formations and wing level in air formations. Some of the TLDOs could be assigned to these centers, and select personnel from combat arms and combat support MOSs should form the rest of the cadre. Personnel should be assigned based not on rank but on their specific skills, leadership and teaching abilities, and desire to innovate. The Centers would draw from the knowledge pool of the entire combat formation (e.g. the Marine Division) to maintain cutting edge tactics, techniques and procedures. They should also operate combat observer programs, sending personnel to work with other U.S military units, foreign area officers, foreign
militaries, and civilian enterprises that are developing new technologies with military potential. Finally, personnel from the Centers would be rotated back out to subordinate combat units as "small unit tactical experts." They would augment the Battalion Gunners by providing expertise at lower unit (company/platoon) levels and offer a diverse perspective that is needed in a multi-technology combat environment.

The personnel assigned to such Tactical Innovation Centers would also be the link between the operating forces and the research and development (R&D) efforts of the supporting establishment. Extended time in the operating forces would facilitate their focus on specific tactical problems and allow them to share knowledge, and thereby serve to increase expertise and innovation across the force.26 For all this to happen, however, the Army and Marine Corps will have to revise manpower policies.

Step 3: Revise Manpower Policies to Increase Experience, Broaden Education, and Create Networks for Knowledge Management and Innovation

The small unit leader's burden - mental and physical - is one of the greatest challenges for ground combat in the Information Age.27 The addition of TLDOs and the support of tactical experts developed through the Tactical Innovation Center system would provide elite personnel to advise small unit leaders on the employment of new, complex, high-technology combat equipment. The squad, platoon, company, and battalion commanders themselves, however, will shoulder the responsibility to effectively integrate Information Age equipment to accomplish tactical missions.

Officers and non-commissioned officers in the U.S. Army and Marine Corps currently advance through rank on formalized schedule, with little deviation allowed. Personnel spend
specified amounts of time in each billet, and are usually given only one assignment at each level of command (squad, platoon, company etc.). By its rigidity, this system impedes the development “of networks of expertise” that create organizational learning. It also drives out of the service many bright and innovative junior leaders.28

To become more adept at exploiting the social and technological characteristics of the Information Age, Army and Marine Corps should adjust manpower policies to vary the time different leaders spend in different echelons of command; and thereby increase junior leaders’ depth of knowledge in specified areas of interest and create more focus and “slack” within careers of leaders. As previously noted, one of the critical requirements for creating networks of innovation is to facilitate and promote a process that creates “champions of learning” focused on specific areas of concern within the organization. With regards to integration of Information Age technologies, such networking and innovation – the kind that keeps a combat force ahead of its thinking adversary and creates tempo at the operational level – will be improved if the ground services can merge operators/maintainers and end users of new high tech equipment systems with the ground force procurement specialists and doctrine developers in an informal organizational group.

The Army and Marine Corps could institute these reforms by using a self-selection process as part of career advancement to align personnel along specific career tracks tied to key areas of concern for the force. The services could then develop combat leaders in a way that synchronizes their careers with the organization’s internal networks of innovation. Some leaders would spend more time in small unit leadership billets to build tactical experience, while others would align themselves with operational and strategic concerns of the force through education and broadening assignments.
To begin the process, every small-unit leader should be selected via a screening process prior to assignment to a leadership billet. Following their initial tours in lower-echelon leadership positions, officers and non-commissioned officers would then go through another selection process, wherein they would submit for a preferred development track for the next stage of their career, based on their skills and intellectual passion. For example, during years three 3-9 year of a ground officers career, the career tracks could be as follows:


b. An Operational track: where officers get early assignments on higher headquarters staff, attend advanced service schools, and serve in culturally and educationally broadening foreign service billets or cross-agency assignments with the State Department, Central Intelligence Agency (CIA), etc.

c. An Institutional Management track: where officers serve in manpower billets, recruiting and recruit training, facilities management, and are allocated school assignments to study best management practices of other organizations.

The tactical-track officers and soldiers/Marines would serve to ensure continuity of knowledge between combat units, training commands, and the R&D efforts of the supporting establishment, focused on the integration of new weapons and tactics. Some of these personnel would serve multiple tours in small unit leadership billets. Thus, while most elements within ground units would still be led by young, physical first-tour leaders, there would also be a designated number of leaders at each echelon with more time in grade who would be able to share increased knowledge and experience. This would help counteract the need for ever-increasing time required to gain proficiency in team T&R standards.

Operational-track personnel would be immersed in the study of military history, politics, and other social sciences and operational art to provide continuity and linkage of operational and
strategic issues of concern to ground force. Institutional-track personnel would ensure that the ground force is sustained at maximum effectiveness.

Such innovations would disrupt current paradigms of manpower management, but they are attainable. Figure 2 provides an illustration of how such a program would work within manpower constraints. The Marine Corps could use the existing career retention board process to allow junior officers to select between the three career paths for the remainder of their company-grade service; and then use similar process for the field grade phase of a career, correlated with the screening process for intermediate-level education. Similar career-track options should be implemented for enlisted personnel at the rank of sergeant, which could be modeled along the first sergeant/master sergeant selection process that enlisted Marines face when preparing to advance beyond the rank of E-7.

Reorganization of Combat Units

With the implementation of the three foundational steps above, America’s ground forces will be postured to create more capable, adaptive, and responsive combat formations. The Army and Marine Corps can then carefully re-calibrate the organizational structure of combat units to meet the threats of the next war. New technologies, with their operators and maintainers, may be integrated into existing combat units or placed in functional units that operate in a supporting role. In battalion-size and above combat units, commanders would also be able employ tactics that exploit the differing expertise of their subordinate leaders who have been developed through the varying career tracks. 31

As technology and weapons change, the specific organization of combat units should be determined based on the characteristics of the technologies and tactics of the time and the threat
forces the US is likely to encounter. Figure 3 provides one example of how an infantry battalion of the future might look. In this scenario, robots and small UAVs are integrated within the battalion to execute reconnaissance and support-by-fire functions. Line companies remain unchanged for the most part, but some personnel are replaced by technical experts from the Innovation Center/Tactical Career Track to facilitate better tactics and equipment integration. The unit commander would be free to shuffle his personnel and capabilities based on his assessment of mission and the personal strengths of the individuals under his command.

Figure 3 is simply a snapshot of one possible organization; the three foundational proposals outlined in this paper would facilitate a variety of combat formations. The details of forming new capabilities within a force with limited budgets and manpower resources are beyond the scope of this paper, but would be a necessary step to keep America’s ground forces superior in quality over our adversaries.

SUMMARY AND CONCLUSION

The character of ground combat is evolving. New technologies used by America’s enemies in Iraq and Afghanistan to create standoff effects with explosives should be considered the tip of the iceberg for how Information Age conditions will affect ground warfare. The multitude of devices American ground forces came to employ by the end of those wars to protect the force and compete for mobility is a harbinger of challenges to come. Moreover, new threats and ever increasing costs for American air and naval forces to achieve air and sea dominance means that ground forces must be more innovative to ensure that combined arms effects can be achieved in contested environments. Lessons from other organizations show that American
military forces must increase individual expertise and focus on innovation in order to be successful in the Information Age.

America's ground forces need experienced and innovative leaders and operators at all echelons to win deep, highly complex engagements against enemy forces using multiple mixed-technology weapons systems. Institutionalization of technical billets within ground combat units, formalization of combat unit centers for knowledge management and innovation, and a more flexible manpower system that develops knowledge and expertise within unit leadership can achieve these aims.

The ongoing diffusion of advanced technologies around the world will continue to alter ground combat in ways not yet foreseen. Innovative units will prevail over the recalcitrant. It is time for American ground forces to take better advantage of the opportunities of the Information Age.
As Clausewitz observed and history has demonstrated, inter-human violence will tend naturally to conflagrate into total war. It is the controlling influence of political forces that compels combat leaders to back away from uncontrolled escalation and towards an equilibrium state where political accommodation can occur.

American ground forces entered the Iraq and Afghanistan wars without defensive capabilities against weapons that could be initiated with remote control equipment using radio-wave, passive and active infrared, and cell phone technology, for example. Such devices are widely available in commercial markets and were easily exploited for military use by insurgents.

Weapons similar to IEDs – booby traps and mines – have long been a prominent aspect of irregular war, but what was new in the Afghanistan and Iraq wars was how anti-American forces had found the IED to be a highly suitable mechanism for employing Information Age technologies to engage US forces at greater standoff ranges. Readily available technologies in commercial marketplace transformed the battlefield impact of IEDs, giving them vastly enhanced operational significance. In Afghanistan, simple low-metallic devices built from Chinese battery components and homemade explosives made from chemical products used in modern commercial agriculture proved a daunting challenge to American forces. In Iraq, sophisticated systems with explosives charges machine-built in Iranian factories, initiated by cell phones, passive infrared, active infrared and other technologies, caused horrific and highly publicized casualties to American forces conducting security and stabilization operations. Many unit leaders found enemy use of IEDs so prevalent that they considered the IED as the primary enemy weapon. See after action reports (AARs) from 1st Marine Regiment (2011), 3d Bn, 7th Marines (2012) and 1st Bn, 6th Marines (2010). See also Jackson pp. 3-4, and Petrillo pp. 6-8.

Successful combat units in Iraq and Afghanistan re-tasked infantrymen with numerous collateral duties, reducing direct-fire combat power to increase the effectiveness of the new systems. Typical patrols in Afghanistan would carry and employ electronic warfare (EW) jamming assets, electronic surveillance and direction finding equipment, metal detectors, interrogation tools (sickle), explosive sniffing dogs, company-level UAVs, small robots, and ground penetrating radar. See Task Force Leatherneck C-IED Leaders Guide, 2012.

In Iraq and Afghanistan, changes in equipment and tactics were initiated both top-down and bottom up. The equipment shown in Table 2 represents the consensus of Marine ground combat element leaders in Afghanistan in 2012 on the best set of assets for the threat environment at that time. See 1st Marine Division AAR, and Task Force Leatherneck C-IED Leaders Guide, 2012.

For example, some Europeans believed that “proper European armies” would not be forced to succumb to the technical and tactical factors that had led to trench warfare in the American Civil War, the Boer War, and Russo-Japanese War. Bradley J. Meyer, Storm Troop Tactics, 2008, pp 2-3.

Some airpower advocates argue that precision-guided munitions (PGMs) can make up for the reduced number of aircraft by achieving greater effects with fewer weapons and platforms. This line of reasoning, however, focuses solely on firepower and does not address other areas of support to the ground force such as observation and electronic warfare. Additionally, even the most sophisticated aerial delivery platforms sometimes cannot provide the precision required for operations in modern war. One example is the use of electronic warfare for pre-detonation of IEDs.

Future adversaries will look for ways both to reduce American dominance of air and observation spectrums and to engage American forces out of range of American weapons systems. They will almost certainly continue to use the types of IED systems that were proven effective at inflicting casualties without having to directly confront American firepower.

The Marine Corps, for example, is strongly committed to the paradigm of air-ground integration. Looking into the future, the Marine Corps in particular should expand its institutional aperture to focus on development of enhanced ground support capabilities for the exact same reason that Marines were so eager to develop close air support (CAS) tactics in the 20th Century: the need to operate expeditiously where traditional mass fire-support systems are unavailable.

FM 3-21-10, Infantry Rifle Company.

Marine General James T. Mattis has expounded on the value of having “cocky, macho, unselfish, and morally very straight young men and women” to fight America’s wars. Mattis, “Ethical Challenges in Contemporary Conflict: The Afghanistan and Iraq Cases” (lecture, United States Naval Academy, Annapolis, MD, February 2006).
With regards to training, Thucydides maxim “he is best who is trained in the severest school” is no less relevant for today’s combat units than in any previous era. Thucydides, *The Peloponnesian War*, Book 1, 1.84 (3).


13 While US military personnel today are better educated and more capable than ever before, relative to their counterparts in high tech American and foreign businesses, they remain a low-skilled force. An infantry platoon in the future may find itself on the front edge of a highly technical battle, in which case it would require more highly skilled personnel than the current force design provides.


18 Ground units in Iraq and Afghanistan repeatedly requested better efforts from the supporting establishment to simplify equipment for combat use. Such initiatives have value and should be pursued, but not at the expense of limiting the operational impact of a new technology. The deciding factor is a thinking enemy. Whichever belligerent can employ the technology better – whether by simplifying equipment, sacrificing individual effectiveness to gain volume in employment; or by using expert operators in combat formations to employ complex systems to the utmost of their capability – will have the advantage. The answer for each weapon system will be unique to its characteristics.

19 The Iraq and Afghanistan wars revealed that commercial contractors had few problems recruiting people for combat duties when the applicants did not have to commit to the long-term contracts of military service or to the indignities of enlisted life. Amongst the technical specialists, personnel who deployed to teach Marines and soldiers the new advanced systems often showed a desire to go out on patrols with combat units.

20 Numerous additive training requirements were incorporated into the pre-deployment training program (PTP) to prepare units for combat in Iraq and Afghanistan. However, PTP was often inadequate, and continual small unit retraining during combat tours was needed to keep Marines and soldiers alive. See AARs from 1st Marine Division, 2012, and 1st Regimental Combat Team, 2011, as examples.

21 Battalion Gunners provide a tremendous asset to combat units, and the demand for their skills has never been higher. One disadvantage of the program, however, is that there is only one career path to become a dedicated advisor in tactics, techniques, and procedures at the infantry battalion level. The evidence from organizations that have successfully institutionalized innovative practices suggests that a greater diversity of perspectives could benefit ground combat formations.

22 Among the efforts to assist combat units in integrating multiple new equipment capabilities in Iraq and Afghanistan, one response that was widely praised by combat leaders was the use of Joint Expeditionary Team (JET) advisors. The JETs consisted of carefully selected retired Special Forces operators and law enforcement experts who accompanied infantry patrols in combat, and in a non-attributional fashion shared best practices on tactics, techniques and procedures. In effect, the JETs were filling in as a “40 year old mind” that lieutenants and squad leaders had not had time to develop.

23 The most successful units in Afghanistan conducted weekly/monthly “re-set” training at patrol bases, and some regiments pulled squad leaders away from their units, out of the fight, to conduct symposiums in theater to share valuable lessons learned. While these efforts helped mitigate the “IED threat,” they diluted leadership attention and resources from higher value operational concerns such as focus on the enemy strategy or host-nation engagement efforts. See AAR from Regimental Combat Team (RCT)-1, 2011, Afghanistan Deployment in Helmand Province. In this regard, the Marines’ experience in Afghanistan is not unique but rather reflects the learning process of combat units in many other wars. During World War I, the Germans established training schools near the front lines which
exploiting the differing capabilities of their

31 This concept is similar to that employed by the French in the post-Revolutionary Wars of the late eighteenth century. French commanders were able to create considerable dilemmas for their adversaries by systematically exploiting the differing capabilities of their “professional” and “citizen” soldiers using the demi-brigade system.

leaders. These organizations exist and function because operational commanders are willing to sacrifice capacity elsewhere in order to have a “school” organization within the combat formation.

26 Currently, US military services use the Urgent Universal Needs Statement (UUNS) process to augment formal R&D systems and procure emergent technical solutions to support new tactics. During recent wars, however, it became apparent that this process is hampered by the fact talented innovators who propose an UUNS - with their accompanying ideas on tactical implementation - typically depart the theater and often the operating force before the proposed UUNS technology becomes available. Furthermore, often the best technical and tactical responses are specific to a local battlespace/threat environment and not "universal."

27 In Iraq and Afghanistan, the task of effectively employing and integrating the new technologies of Information Age warfare with the tactical considerations of the battlefield environment fell on small unit leaders. One Marine cogently summed up the problem of preparing squad leaders for modern combat as follows: “We are trying to put at 40-year old mind in a 21-year old body” (CW03 Larose, Regimental Gunner, Regimental Combat Team-6, 2012.) Training time and additional repetitions helped increase operator competence, but squad, platoon, company, and battalion-level leaders began to see vastly increased spans of responsibility with regards to the systems and diversity of capabilities they were expected to effectively employ. Everything a small unit leader in the past had to know about the equipment shown in Table 1 - maximum effective ranges, arming distances, casualty radii, safety distances, immediate action drills, first echelon maintenance - was still applicable to the small unit leaders in Iraq and Afghanistan, but added was the requirement for comparable proficiency with the new equipment in Table 2. To be effective on patrol, a small unit leader had to attain a certain degree of expertise all available systems, and then apply them appropriately to the terrain, enemy threat, and environmental/cultural factors specific to the patrol. Despite the extraordinary capabilities of American servicemen, this was a difficult challenge. Leaders grappled with a multidimensional chess game–the requirement to scheme tactical strategies accounting not only for physically observable enemy systems, but for unseen “bubbles” of EW, remote control trigger-men, enemy leaders coordinating action from village internet cafes, and so on. See again Figure 1, which attempts to graphically illustrate this problem.

28 Army studies conducted in the 1970s and again in the mid 2000s showed that two primary explanations cited by junior officers as their reason for leaving the service were micromanaging senior officers and lack of control over their career paths. See Ricks, The Generals (New York, NY: Penguin Books, 2012) pp. 390-393.

29 In addition to selection, qualification courses for small unit leaders must be highly demanding and focus on effective decision-making amidst the fear and uncertainty of war. Powledge provides an excellent study with sound recommendations and a solid methodology for how squad leaders should be selected and promoted. He also recommends training requirements for squad leader for future war. Powledge, “The Decision Gap: Developing Squad Leaders for Future Operations (Quantico, VA: Marine Corps University: 2011), pp. 5-6, 13-14.

30 The ground services have thus far reacted to the challenges of modern combat by focusing on school training rather than increased operational time. Marine Corps has made commendable efforts to improve qualification schools, such as the Marine Infantry Officer and Infantry Squad Leaders Courses. The Army has made similar strides. But school training alone cannot fully duplicate experience. Furthermore, school knowledge will become dated more quickly in an era where new tactics and innovation can be instantaneously shared around the world via modern communication systems.

24 Personnel who serve in Division Schools are pulled from other Table of Organization (T/O) billets in the combat units. These organizations exist and function because operational commanders are willing to sacrifice capacity elsewhere in order to have a “school” organization within the combat formation.

23 To maximize efficiency in the midst of resource and manpower constraints, the division/group/wing-level is the appropriate echelon for a Tactical Innovation Center. Above this level, focus would be diluted by the varying requirements of the different elements of the combined arms team. Below this level, while there might be benefit from such a program (similar to the model of the Sapper Schools operated by Marine combat engineer battalions), it would be difficult and inefficient to sustain the required capabilities with available manpower.

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Table 1:
USMC Infantry Battalion Task Force, 2001

LIST OF SIGNIFICANT WEAPONS, INTEL, AND ANTI-TERRORISM/FORCE PROTECTION (AT/FP) SYSTEMS (DOES NOT INCLUDE COMMUNICATIONS ASSETS)\(^1\)

Weapons and Equipment in use at the start of the Iraq/Afghanistan Wars

**ORGANIC TO INFANTRY**

- M16A4/M4 Rifle
- M249 SAW
- M203 40mm grenade launcher
- M240 medium machine gun
- Mk19 40mm heavy machine gun
- M2 .50cal heavy machine gun
- M224 60mm mortar
- M252 81mm mortar
- Mk153 shoulder-launched multi-purpose assault weapon (SMAW)
- AT-4/M-72 Light Anti-Armor Weapon (LAW)
- Javelin anti-tank weapon
- Tube-launched, optically tracked, wire guided (TOW) missile
- M40 sniper rifle / Special applications scoped rifle (SASR) (.50cal)
- Hand grenades
- Night vision equipment (AN/PVS-14, etc)
- Target point illuminator (AN/PEQ-2, replaced by AN/PEQ-15)
- Thermals/Imaging equipment (AN/PAS-13)

**DIRECT SUPPORT (DS) ENABLERS**

- AN/PSS-12 Metal Detector (Combat engineer battalion)
- AN/PSS-14 Mine Detector w/ ground penetrating radar (GPR) (Combat engineer battalion)
- Intelligence Battalion and Radio Battalion enablers (Unmanned ground sensors, UGS, Human Intelligence Exploitation Teams, HET, etc)
Table 2:  
USMC Infantry Battalion Task Force, 2012

New Weapons and Equipment added during Iraq/Afghanistan Wars

ORGANIC TO INFANTRY:
THOR III Counter Remote Control Electronic Warfare (CREW) Suite (collateral duty for 2-3 infantrymen per maneuver element)
SWATS (threat point-of-origin, POO, locating device)
Vallon VMC-1 or CEIA CMD Metal Detector
(became a collateral duty for infantrymen in addition to engineers. One per maneuver element)
Sickle (Holley) Stick manual confirmation tool
(became a collateral duty for infantrymen in addition to engineers. One per maneuver element)
Wolfhound Communications / Electronic Detection Device
(requires three collateral duty operators on patrol if employed as a suite to obtain full capability)
IED-Detection Dog
(Infantrymen were assigned as dog handlers full-time duty, 12-35 per battalion. Additional 18-35 dogs/handlers in Combat engineer battalion)
VISDES Enhanced Individual Optic Suite (LRS, monocular, thermals/optics)
Raven (Company-level UAV)
Recon-Scout Throw-bot (platoon/squad reconnaissance robot)
Persistent Surveillance Equipment (Aerostat, GBOSS, Cerberus Light) (Intel and Force Protection asset. Infantrymen and battalion staff enablers assigned as operators. Assets down to company level in some cases)

DS ENABLERS
Vallon VMR-2 Ground Penetrator Radar (combat engineer battalion)
Goldie IED detector (combat engineer battalion)
Husky Vehicle Mounted Metal Detector and Ground Penetrating Radar (combat engineer battalion)
Buffalo vehicle mounted IED interrogation tool
Puma Company UAV (combat engineer battalion)
T-Hawk Company UAV (combat engineer battalion)
Vehicle Mounted Optics Suite (VOSS/gyrocam) (combat engineer battalion)
SUG-30 PACBOT (Medium Robot) (combat engineer battalion)
Tallon Robot (EOD and combat engineer battalion)
Pre-detonation systems (op-tested but not fully fielded) (MaxPower, Tarantula, Kraken) (combat engineer battalion)
Intel Battalion and RadBn enablers (UGS, HET – significantly enhanced assets)
FSRs – Minerollers, ECM, VOSS/GBOSS, Aerostat, VISDES, Buffalo, Husky, etc.
Intelligence Contractors (All source analysis – DIA & COIC, Counterinsurgency Targeting program - NGIC, others)
### Table 3:
**Future Infantry Battalion Task Force (ca 2027)**

<table>
<thead>
<tr>
<th>Potential New Weapons and Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced optics and sensors (threat detection and orientation)</td>
</tr>
<tr>
<td>Electronic warfare equipment (Electronic protection, threat communications detection and location finding, etc)</td>
</tr>
<tr>
<td>Small UAVs (reconnaissance, spotting, weapons delivery)</td>
</tr>
<tr>
<td>Robotics (reconnaissance, spotting, weapons delivery, logistics support)</td>
</tr>
<tr>
<td>Directed energy weapons (threat engagement)</td>
</tr>
<tr>
<td>Ground penetrating radar for locating underground threats (force protection)</td>
</tr>
<tr>
<td>Pre-detonation of explosive hazards (force protection)</td>
</tr>
<tr>
<td>Personal mobility enhancements such as exoskeleton technology (maneuver, logistics)</td>
</tr>
<tr>
<td>Anti-air, anti-UAV systems (force protection)</td>
</tr>
<tr>
<td>Hand held computers and communication devices (C2)</td>
</tr>
</tbody>
</table>

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1 Source for Tables 1-3: USMC Infantry and Engineer Tables of Equipment, 2001; 1st Marine Division AAR, OEF 2012; TF Leatherneck C-IED Leaders Guide 2012; MCWL Warfighting Lab, Marine Expeditionary Rifle Squad (MERS) Research Division and C-IED Division, Marine Corps Systems Command, Quantico, VA.
Figure 1: Battlespace

Offensive Systems: Direct Fire and Indirect Fire Weapons, Directed Energy, Identity Dominance, Human Terrain Analysis


Logistic Enablers

UAS (Copperhead, etc.)

Company-level UAVs: Raven, T-Hawk, Puma

PUG & POG

MTV/SPC
Eye Protection
Combat Hunter
VISDES
Minehound/Goldie
Holley Stick
CREW (Thor III)
HIIDE/SEEK II
Wolfhound
Forensic Exploitation Kit

IDD

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IDD
**Figure 2: Example Career Track Progression Matrix (Company Grade Officers)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Officer #1 MOS School</th>
<th>Year 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bn-level (Pit Ldr)</td>
<td>Bn-level (Pit Ldr)</td>
<td>Bn-level (Pit Ldr)</td>
<td>Tactical B Billet</td>
<td>Career Course</td>
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<tr>
<td>Officer #2 MOS School</td>
<td>Bn-level (Asst Pit Ldr/Pit Ldr)</td>
<td>Tactical B Billet</td>
<td>Bn-level (Pit Ldr)</td>
<td>Bn-level (Co Cdr)</td>
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<tr>
<td>Officer #3 MOS School</td>
<td>Tactical B Billet</td>
<td>Bn-level (Pit Ldr)</td>
<td>Career Course</td>
<td>Institutional B Billet</td>
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<tr>
<td>Officer #4 MOS School</td>
<td>Bn-level (Pit Ldr)</td>
<td>Institutional B Billet</td>
<td>Career Course</td>
<td>Bn-level (Co Cdr)</td>
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<tr>
<td>Officer #5 MOS School</td>
<td>Bn-level (Pit Ldr)</td>
<td>Career Course</td>
<td>Language Sc</td>
<td>Operational B Billet</td>
<td>Bn-level (Co Cdr)</td>
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<tr>
<td>Officer #6 MOS School</td>
<td>Bn-level (Pit Ldr)</td>
<td>HHQ Staff Officer</td>
<td>Career Course</td>
<td>Adv Course</td>
<td>Bn-level (Co Cdr)</td>
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<tr>
<td>Officer #7 MOS School</td>
<td>Bn-level (Pit Ldr)</td>
<td>elects to leave active duty</td>
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<tr>
<td>Officer #8 MOS School</td>
<td>Bn-level (Asst Pit Ldr/Pit Ldr)</td>
<td>elects to leave active duty</td>
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**Tactical Track**

**Operational Track**

**Institutional Track**

*This model reflects a 3-tier career track selection process at Year 4, with officers remaining in their assigned track for Years 5-10. A subsequent selection process would take place in Year 10: i.e., personnel would not be stuck in the same career track for the duration of the career.*

**The total number of Bn-level leadership billets for first term and second term officers corresponds with the Future Infantry organization chart in Figure 3. This model also reflects that some new formations that employ highly skilled personnel (robotics or UAV platoon, etc.) may use a second combat arms lieutenant as assistant platoon commander. The model would be refined based on the total billet requirements of all units in the ground force.*

***Because some of the platoon leadership billets have been designated for second-tour commanders, a certain number of new lieutenants graduating from MOS school will not immediately be placed in a command role. The model is designed in this regard to facilitate use of selection criteria for leadership billets. Some officers graduate MOS school as technically capable managers but would benefit from additional time working with troops to develop leadership proficiency. In this model, these officers would be assigned to assistant leadership billets in the technical platoons, and/or to some tactical B-billets (such as Division schools) to take advantage of their skills and help them develop as military professionals. Officer #3 represents such an individual in this example.*
FIGURE 3: Future Infantry Battalion
Task Organization

Rifle Company #1
(6) Officers/ (176) Enlisted
(1) O-3 0302 CO (Second Tour)
(1) O-2 0302 XO
(1) O-2 0302 (Second Tour)
(3) O-1 0302
(1) 8999 First Sergeant
(6) 0369 Infantry Unit Leader
(3) E-5/E-6 03XX Technical Specialists
(1) Any MOS Technical Specialist
(117) 0311 Rifleman
(9) 0341 Mortarman
(12) 0351 Assaultman
(21)0331 Machine Gunner

Rifle Company #2
(6) Officers/ (176) Enlisted
(1) O-3 0302 CO
(1) O-2 0302 XO
(1) O-2 0302 (Second Tour)
(3) O-1 0302
(1) 8999 First Sergeant
(6) 0369 Infantry Unit Leader
(3) E-5/E-6 03XX Technical Specialists
(1) Any MOS Technical Specialist
(117) 0311 Rifleman
(9) 0341 Mortarman
(12) 0351 Assaultman
(21)0331 Machine Gunner

Rifle Company #3
(6) Officers/ (176) Enlisted
(1) O-3 0302 CO
(1) O-2 0302 XO
(1) O-2 0302 (Second Tour)
(3) O-1 0302
(1) 8999 First Sergeant
(6) 0369 Infantry Unit Leader
(3) E-5/E-6 03XX Technical Specialists
(1) Any MOS Technical Specialist
(117) 0311 Rifleman
(9) 0341 Mortarman
(12) 0351 Assaultman
(21)0331 Machine Gunner

Robot and UAV Platoon
Weapons Company
(1) O-4 0302 CO
(1) O-2 0302 XO
(1) O-2 0302 (Second Tour)
(2) O-1/O-2 0302
(12) Technical LDOs
(5) E-5/E-6 Technical Specialists
(128) Enlisted (various MOs)

Notes: Total manning number is the same as current USMC Infantry Battalion T/O.
Summary of changes:
*(1) Company CO is now a second-tour commander in the Tactical Track Program.
*(4) Platoon Commanders are second tour officers in the Tactical Track Program
*(17) Enlisted leaders are second tour Marines in the Tactical Track/Division Schools Program
*(12) Enlisted billets converted to Technical LDOs
*Heavy gun and anti-armor platoons are reduced to sections as some of their functions are now executed by robot/UAV/EW platoon.
Bibliography:


Mattis, James T. “Ethical Challenges in Contemporary Conflict: The Afghanistan and Iraq Cases” (lecture, United States Naval Academy, Annapolis, MD, February 2006).


