

Preparing the Army for Force XXI

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The framers of the Army 2010 Conference wanted to begin their discussion by considering the context within which recruiting would take place fifteen years hence. This essay therefore centers upon the infantry soldier (historically, the "lowest common denominator" for quality) and the U.S. Army Training and Doctrine Command (TRADOC), that has the mission of articulating requirements for future personnel and equipment and of developing future doctrine and training techniques.

The Army has just emerged from decades of neither-war-nor-peace. Contemplating the century ahead, professional soldiers ponder oncoming technology that would surely gainsay most, if not all, the concepts and structure that the Army had developed to meet past challenges. Some professional soldiers see such changes liberating the Army for broader missions and for re-focused training; some rue them as leaving the Army isolated and aimless with few sources of external support and sparse consensus on its future. To be sure, there has been doctrinal ferment, even a reasonably useful pass by Leavenworth at new formulations on tactics. Moreover, the Army's senior general, about to leave office, can look with satisfaction on his efforts to invigorate the Army's doctrine, its institutional training, and its training in units. But how would these reforms wear in the new century? Could the Army adapt to radically different strategic and tactical circumstance and win against enemies who had mastered the new technology?

We know with some precision the answer to that question. I write of the year 1895, not 1995, and describe circumstances surrounding the demise of the Indian Fighting Army, not that of Fulda's Cold War guardians. Then the professional issues were smokeless powder, magazine rifles, machine guns, and telephones, not digitization or information warfare (Jamieson, 1994; Weigley, 1967). I write of a year when the Army allowed budget to dominate strategic vision: the Army sold, for seven cents on the dollar, the fleet of heavy wagons that had endowed its units with operational mobility in their winter campaigns against the Indian nations only to have to buy three years later, at a premium, replacement lift for the invasion of Cuba (Weigley, 1967). I refer to the Leavenworth infantry and cavalry manuals of 1891, not FM 100-5 of 1993, or TRADOC Pamphlet 525-5 of 1994. And of course I mean John Schofield, not Gordon Sullivan. The questions posed above about the Army of 1895 were answered definitively — as such questions always have been answered — in battle. In Picardy, around the ruins of the village of Cantigny, on May 28, 1918, in the first offensive of the U.S. Army in World War I, the 1st Infantry Division proved to a skeptical world that Americans could take and hold ground on the Western Front. The answer was unequivocal: the U.S. Army could adapt, could rise to greatness. The implications of Cantigny for the present, and for the future, proceed from its cost: the U.S. 28th Infantry Regiment that led the attack lost half its officers and one third of its soldiers (Millett, 1986). Theirs was a predictable fate. The conclusion of one landmark study of ten initial battles in major American wars — a bleak recital of costly defeats and Pyrrhic victories, including Cantigny — was that "won or lost, the first battle almost guarantees that

* In *Future Soldiers and the Quality Imperative—The Army 2010 Conference*. Phillips, RL and Thurman, MR, eds. USAREC, 1995. Part I, Chapter 1.

inexperience will be paid for in blood" (Shy, 1986, p. 329), Green American units have repeatedly exhibited a propensity for headlong assaults and other stereotyped tactics; they have time and again paid for inflexibility and ineptitude with inordinately heavy casualties. In the spring of 1917, green indeed was the Big Red One, the 1st Division's sobriquet, alluding to its shoulder patch. In April 1917, following 120,000 casualties in the Nivelle offensive, there were mutinies in 54 French divisions, half of the French Army. In May, Marshall Joffre came to the United States to call for immediate help, or at least one token division's worth. The British anxiously seconded the request. The Big Red One was America's answer to Allied desperation; the War Department hastily formed the 1st Division around four understrength Regular Army units then spread in small detachments along the Mexican border in Texas —the 16th, 18th, 26th and 28th Infantry Regiments (Weigley, 1967). Regular soldiers were in demand for other mobilizing units, so the 1st Division received from them only small cadres with regimental colors.

When the division landed in France toward the end of June 1917, two thirds of its soldiers were raw recruits. George C. Marshall (1976), second man ashore, described them as "not impressive. Many of the men were undersized and a number spoke English with difficulty" (p. 8). Among its leaders, six out of ten sergeants and five out of ten company commanders had no prior military service. There had been no pre-deployment training. Many riflemen were issued their arm on the train traveling to the port of embarkation, and weapon crews theirs, largely of French manufacture, after they arrived overseas. The division command group met on the ship. In short, the 1st Division at that time was a political gesture, devoid of meaningful combat power.

The necessary months of individual and collective training that ensued (under French tutelage) engendered serious political and strategic tensions for General Pershing, who was trying to stave off parceling out units of the American Expeditionary Force to beleaguered Allies as stopgap replacements. Pershing aspired for the AEF to create in France an independent American field army, co-equal with French and British armies, that would drive the Germans out of prepared defenses, so that Americans could fight the "open warfare" for which he was convinced they were uniquely suited. Pershing thus hewed to Army doctrine, for Field Service Regulations, the FM 100-5 of the time, held that only infantry rifles and bayonets could win decisive results; other arms and services might contribute to advancing infantry marksman into range, but ultimately it was aimed rifle fire that would win.

The 1st Division was Pershing's bellwether. On 1 April, 1918, just one year after the U.S. declaration of war, Pershing, under heavy pressure to shore up the French before an ominous German onslaught, ordered the 1st Division into the field for a divisional exercise in "open warfare," and on 17 April started it marching north, toward Cantigny. When the Big Red One proved there that it could launch a coordinated attack and could hold onto its gains despite furious German bombardment and persistent infantry counterattacks, it confirmed Pershing's strategy.

Cantigny deserves to be celebrated as well as a triumph of the division's leadership, including that of George C. Marshall, who, the division commander being sick, planned and

supervised the operation. Overall, however, this Nation needs to remember that what won the battle at Cantigny was the courage, tenacity, and sacrifice of "unimpressive" infantry soldiers.

The A.E.F., the Army, and the United States ought to have provided them better preparation. Russell Weigley (1967), the noted historian, minced no words:

The indictment of United States policy as one of chronic unpreparedness for war best fits the First World War. On April 6, 1917, when Congress responded to Wilson's war message, the United States Army was less ready for the task ahead of it than at the opening of any previous conflict, not excepting the War of the Revolution or the War of 1812. Never before had the foe been so formidable in numbers and military skill; never before had the conflict demanded so complete a mobilization of the whole nation; never before had the government faced problems of the magnitude of those posed by the decision to carry the Army to the battlefields of Europe itself. ... (p. 352)

The Army of today, planning for Force XXI, should do all in its power to forestall "chronic unpreparedness," and resolve to avoid another Cantigny.

Preparedness for What?

I believe it unlikely that anyone —surely not this writer— can usefully define the worldwide challenges for the U.S. Army in 2010 beyond the formulations in TRADOC Pamphlet 525-5 that urge fashioning over the next fifteen years an Army prepared to conduct operations on land on behalf of the United States wherever and whenever the national interest and the orders of the President may require. Those operations could be opposed with any of several types of advanced weaponry, such as ballistic missiles tipped with conventional explosives or with nuclear, biological, or chemical weapons. They will surely involve information warfare and require that U.S. Army units be adroit with information technology for both offensive and defensive purposes. It is also certain that Army forces will operate under one of the U.S. Combatant Commanders, necessitating joint teamwork at all echelons, and probable that they will have to cooperate with one or more partners in an international coalition.

Projecting Army forces from within the United States to an overseas theater of war will require strategic mobility that does not impair the ability of those forces to dominate tactical maneuver once deployed. Army units will be expected to use firepower with both precision and discrimination, to provide in some measure for their own protection and to sustain themselves efficiently. But the Army will also be expected to execute missions of peacekeeping, of humanitarian aid, or of support for democracy and the rule of law. If history can instruct the Army about its future, it is simply that Force XXI must be ready for the unforeseen, to be able to counter any enemy, domestic or foreign, and act on order to compel, to deter, to reassure, or to support foreign countries, their people, or their military forces. Within Force XXI, dismounted combatants, particularly infantrymen, are likely to be more important than they have been in the Army of the Cold War. Operations like Grenada, Panama, and Somalia seem more probable than those resembling Desert Storm. As the performance of American infantry at Cantigny fashioned the future of Pershing's Army, so the performance of American infantry in Force XXI is likely to be the measure of its success or failure. Infantry is, moreover, already targeted for a massive infusion of advanced information-age technology that, being largely absent in today's infantry equipment, represents the greatest change facing any branch as it transforms itself for Force XXI. One information bulletin issued for participants in the Army 2010 Conference asserted that "the

difficulties of fielding a successful Army in the early 20th Century pale alongside the requirements of accessing quality soldiers into the Army of the early 21st Century." My own conviction is to the contrary. The Army of 1995 is held in much higher regard today by the people of the United States and their elected representatives than was the Indian-hounding, strike-breaking Army of 1895, and, more importantly, today's Army has far better ways to inform the public about its undertakings, and to gauge and respond to market as it seeks to attract, to train and to retain quality soldiers. These advantages, if carefully exploited over the decade ahead, should guarantee that the Army of 2010 would be incomparably superior to the Army of 1910.

I would also argue that in the event — God forbid — the year 2018 should find our soldiers committed to battle abroad, Force XXI could and should have the means to assure victory without the strategic and tactical costs of Cantigny. All of these means are nascent in the Army of 1995; all can be brought to maturity apace with the proliferation of information age technologies; all are information age technologies. The circumstances of today are not unlike those the Army faced in the aftermath of Viet Nam. Then the shortsighted looked back: "Peace at last. . . now the Army can recover its former morale and efficiency." Others looked ahead: "How should the Army meet the challenges of the future?" In 1973 men of the second frame of mind created TRADOC. The results were not uniformly felicitous, particularly in the late '70s, when, for several reasons, recruiting faltered, soldier quality fell sharply, and some of TRADOC's more venturesome experiments with training foundered. But overall, TRADOC was an idea whose time had come. My instinct tells me that the Army, to advance toward Force XXI, will have to recreate TRADOC, to realign the priorities of that command, and to devise ways to resource its initiatives. Ahead lie years of urgent, demanding combat and training developments if Force XXI is to be provided with proper doctrine, training, leadership, organization, and equipment, and if it is to be manned by quality soldiers. I have formed my thoughts about a renewed TRADOC around three topics: Tactical Engagement Simulation, Distributed Learning, and Doctrine.

Tactical Engagement Simulation: The Army of the Industrial Age

For much of the 20th Century, the Army, to meet the nation's growing responsibilities abroad, relied upon conscription and planned mobilization of battle-worthy divisions predicated on training of individual draftees and newly appointed officers in military schools or training centers, followed by training under the cadre of a newly activated division charged to fashion individuals into teams. The Army provided the curriculum for unit training, prescribing what subjects to train, how to conduct the training, and what time should be devoted to each subject. This "factory system" drew heavily upon the hortative pedagogy of the Industrial Revolution, as well as emulating assembly line production (Rainey, 1993). At the time, there was little perception that this system might be based on a flawed estimation of quality: many military professionals and the American public at large persistently entertained romantic notions of their countrymen as "inspired amateurs" — hardy individualists, canny woodsmen, and deadly marksmen, with a natural affinity for soldiering. Yet the unhappy reality was that Army manpower did not match that model, and the Army's industrial-mode of training induced herd-like behavior more lethal among our troops than the enemy's. In the major wars of the 20th Century — World Wars I and II, and the Wars in Korea and Viet Nam — some 400,000 Americans were killed in action, and millions more were wounded (Dupuy, 1990). Eighty

percent of these battle casualties were inflicted on soldiers engaged in close combat on land. Although infantry as a percentage of the force afield declined from war to war, its prominence on casualty lists did not; T.N. Dupuy (1993) predicts that, in any future clash between modern armored or mechanized forces, infantry will constitute less than 15% of combatants, but will sustain 55% of casualties.

Throughout the first 75 years of the 20th Century, the Army's industrial-model mobilizations were foiled by high losses in early battles. During World Wars I and II, and the Korean War as well, unanticipated casualties forced the Army to perturb severely the collective training of mobilizing divisions by draining them repeatedly for individual replacements to refill already deployed divisions. Toward the end of World War II, amid "total" mobilization, the intricate training program designed to produce combat ready divisions broke down altogether (Wiley, 1948). From the start of troop deployments in Viet Nam, the Army concentrated on training individual replacements and essayed relatively little unit training. As a consequence, in the latter years of that conflict, the pre-war cadres of experienced sergeants having been used up, infantry platoons came to be composed almost entirely of youths of similar age and inexperience—lieutenants, sergeants, privates—hurriedly stamped out in replacement training centers and flown directly as individuals into combat.

I commanded a brigade in Viet Nam in 1970-1971 and know at first hand that era of fragging, drugs, and refusals to fight. But I left Viet Nam with an abiding respect and affection for the young infantrymen of my battalions: unfortunate to be drafted, unfortunate to be selected for the infantry, unfortunate to be sent to Viet Nam instead of Europe, unfortunate to end up in my brigade when they might have served elsewhere in Viet Nam, unfortunate to receive daily in the orange mail bags dropped to them in the jungle a stream of counter-doctrine, subversive literature from home, urging on them conscientious objector status or open mutiny. These young men, the most unfortunate of the unfortunate, nonetheless proved willing and able to carry the fight to the North Vietnamese time and again and to dominate the approaches to Hue. I see them often in the famous statues at the Memorial Wall, effigies that capture, in the insouciant battle dress and amateurish treatment of weapons and ammunition, the Army's failure to provide the small unit leadership they deserved.

Combat Developments

When the U.S. Army Training and Doctrine Command was formed in 1973, it undertook holistic evaluation of doctrine, training, leader development, organizations, materiel, and soldier quality (DTLOMS—the incantation is "dotlums") (Romjue, et al, 1993). One set of TRADOC's analytical tools was derived from the predecessor Combat Development Command's exploitation of the simulations of operations research, mathematical constructs of combat, chiefly computerized models, reflecting what was known of actual encounters between hostile forces or among weapon systems. Other tools were laboratory-like ranges instrumented with computers, geo-location devices, and laser-based weapon system emulators that enabled experiments with actual troop units engaged in two-sided, simulated battle: casualties realistically assessed, and battle outcomes portrayed in elaborate detail. Both these forms of simulation—one constructive, one live—soon pointed to conclusions that effectiveness in close combat is dominated less by numbers of soldiers or their equipment, than by battle concept and teamwork—doctrine, training,

leadership, and soldier quality, as opposed to organizations and materiel. Moreover, the combat developers within TRADOC reported to training developers that documented improvements in performance from iteration to iteration of the simulations established that powerfully effective training was taking place. These findings were very controversial, contradicting Army mind-sets that had endured for generations: Americans have a deep-seated fascination for materiel that leads them to look first to equipment for combat advantage and an equally well-rooted disdain for any form of simulation in tactical training.

In 1867 the Army had acted on the recommendation of Major General Emory Upton that it designate as its basic unit a "pair of fours" — eight soldiers — and to train how to fight with these as its smallest tactical element (the basic unit of the Roman legion was the eight-man mess, the *contubernia*.) Seventy years later, on the eve of World War II, American infantry was still organized and trained around Upton's "pair of fours," modified, per the Leavenworth infantry manual of 1891, by adding the term "squad", and dictating "Extended Order" for battle —squads drilled in both "close order" and "open order" at least through 1946. In 1938, the introduction of the Garand M-1 semi-automatic rifle precipitated a quarter-century of professional debate and frantic organizational tinkering. A well-trained soldier armed with a Springfield M-1 903 bolt-action rifle could fire 10 to 15 aimed shots per minute; armed with the M-1, he could double his firepower to 20 to 30 aimed shots per minute. At first, issue of the M-1 led to removing the Browning Automatic Rifle (BAR) from the squad, but as entry into World War II became imminent, for lack of a suitable light machine gun the BAR was added back. Between 1938 and 1964, through the 25 years that included the infantry close combat of World War II and Korea, right up to the Viet Nam deployment, the U.S. Army formally changed the infantry squad's Table of Organization and Equipment at least 15 times. Size vacillated from 8 to 12, to 9, to 11 squad members; organization varied from a two teams to three teams, to a single team, and back to two teams. Most of the changes added either (1) more powerful weapons, or (2) higher rank for squad NCOs. This turbulence is convincing evidence that the Army sensed something was not right with its "basic combat unit," something that badly needed fixing.

The recourses were, however, confined to higher rank for more seasoning among squad members or to additional firepower including and especially better aimed fire in combat; in the mid-'50s, the Army bifurcated the squad into fire teams, assigned each four NCOs, and introduced TRAINFIRE, radical marksmanship training that emphasized engaging human-shaped, pop-up targets. TRADOC's analyses suggested a different approach: battle outcomes depended less upon the squad's headcount, the spread of sergeant stripes among them, or how they were equipped, than upon an idea of how to fight that was shared among squad members, findings quite consistent with the wartime experiences of TRADOC's first commander (DePuy, 1994). "SLAM" Marshall (1947), in his perceptive *Men Against Fire*, warned against misreading the import of a bloodletting like the 28th Infantry's at Cantigny:

. . . they who write of war tend to use loosely the expression "battle-seasoned troops" as if there were a kind of mental toughening which comes from experience under fire. The idea is wholly misleading; it mistakes the shadow for the substance. One of the effects of the shock of engagement is that it shakes the weakest files out of the organization. But as for the veterans who remain, they do not grow more callous to danger as they meet it increasingly nor do they ever become more eager for the contest. . . . Since troops do not conquer the fear of death and wounds, it is idle to think of any such basis for the establishment of a combat discipline. The latter is simply the reflection of the growth of unit confidence that comes of increased awareness and utilization of [the unit's] own resources under

conditions, which at first seem extraordinary but gradually become familiar. Until that kind of confidence is born, there can be no effective action. Green troops are more likely to flee the field than others only because they have not learned to think and act together. Individually, they may be as brave and willing then as during any subsequent period, but individual bravery and willingness will not stand against organized shock. With the growth of experience troops learn to apply the lessons of contact and communicating, and out of these things comes the tactical cohesion which enables a group of individuals to make the most of their united strength and stand steady in the face of sudden emergency. . . . Is it fully appreciated that the most general cause of small failures along our combat line, which frequently promote the confusions of larger bodies of troops, is the individual failure of the American soldier to respect this simple but fundamental principle? Our aggregate tactical weakness stems largely from this failing. We have encouraged the man to think creatively as a person without stimulating him to act and speak at all times as a member of a team. The emphasis should be kept eternally on the main point: his first duty is to join his force to others! Squad unity comes to full cooperation between each man and his neighbor. There is no battle strength within the company or regiment except as it derives from this basic element within the smallest component, (pp. 123-127)

Need American infantrymen wait for their "baptism of fire" to learn "the main point?" TRADOC's training developers thought not, and believed that tactical engagement simulation could act as a surrogate for battle learning.

Training Developments

There were among those training developers in the '70s some who understood that the Roman Empire was founded on the simulation that originally figured in the training of its Legions and lost when Romans abandoned that training technology. In the 4th Century AD Flavius Vegetius Renatus wrote a tract advocating revival of the *armatura*, the method by which ancient Rome prepared its soldiers for war. His little book failed its purpose at the time, but became a primary manual for later military leaders in Western civilization, remaining influential into the 20th Century. According to Vegetius, the Romans paid attention to physical conditioning, javelin throwing, and field engineering technique, but central to the *armatura* was what we today would call an "engagement simulation." For training, each soldier was issued weapon emulators: a wicker shield and a wooden sword, their weight twice that of the actual armament. He was also provided a stout wooden post, long enough to extend six feet above the ground when the end was firmly implanted in a rank representing an enemy force. Then, Vegetius (1944) tells us each soldier was required to attack his post for hours on end:

Sometimes aiming for the head or face, sometimes at the sides, at others endeavoring to strike at the thighs or legs. He was instructed in what manner to advance and retire, and in short how to take every advantage of his adversary; but was thus above all particularly cautioned not to lay himself open to his antagonist while aiming his stroke at him. They were likewise taught not to cut, but to thrust with their swords. For the Romans not only made jest of those who fought with edge of that weapon, but always found them an easy conquest. A stroke with edges, though made with ever so much force, seldom kills, as the vital parts of the body are defended both by the bones and armor. On the contrary, a stab, although it penetrates but two inches, is generally fatal. Besides, in the attitude of striking, it is impossible to avoid exposing the right arms and side; but on the other hand, the body is covered while a thrust is given, and the adversary received the point before he sees the sword. This was the method of fighting principally used by the Romans, (pp. 19-21)

From simulation for individual skill training, a Legion's training regimen progressed into collective field exercises: arduous approach marches, deployment into precise formations, and maneuvers in simulated combat designed to concentrate striking power exactly where the

commander directed, and to present the "enemy" there with rank on rank of interlocked shields, an impenetrable, inexorably-advancing, lethally-stabbing mass of infantry. Josephus, a military historian of the 1st Century, assessed the effectiveness of Roman training in these terms:

This vast empire of theirs has come to them as the prize of valor, and not as a gift of fortune. For their nation does not wait for the outbreak of war to give men their first lesson in arms. They do not sit with folded hands in peace-time only to put them in motion in the hour of need. On the contrary, as though they had been born with weapons in hand, they never have a truce from training, never wait for emergencies to arise. Moreover their peace maneuvers are no less strenuous than veritable warfare. Each soldier daily throws all his energy into his drill, as though he were in action. Hence that perfect ease with which they sustain the shock of battle. No confusion breaks their customary formation, no panic paralyses, no fatigue exhausts them. And as their opponents cannot match these qualities, victory is the invariable and certain consequence. Indeed, it would not be wrong to describe their maneuvers as bloodless combats and their combats as sanguinary maneuvers. (Grant, 1974, pp. xxvii, xxviii)

Simulation was more widely accepted and used in the U.S. Army of 1895 than it was in the U.S. Army of the '70s. During the Annual General Inspection of Fort Leavenworth in 1974, the author noted that students in the Command and General Staff College participated in a two-sided, free play war game only in the final week of their nine-month course. In the final quarter of the 19th Century, American professional soldiers, admiring the victorious Prussian Army, adopted its *Pickelhaube* (spiked helmet) and emulated its training methods, even developing an American form of *Kriegsspiel* (war game) — what we would today call a manual, constructive simulation (e.g., Livermore, 1882; Totten, 1880; Verdy du Vernois, 1897). In the same era, also copying Prussian practice, both the Army and the Navy inaugurated institutional training for officers and centered curricula on battle simulations using maps or terrain rides and either Prussian or Civil War case studies. The instructor of tactics most admired by George C-Marshall, Major John F. Morrison of Leavenworth (Marshall, 1991) regarded *Kriegsspiel* as a superior method for teaching tactics because, in the contest between the opposing sides, something like the stress of battle emerged, and students learned how to cope with it while issuing, interpreting, and executing orders. On a different tactical plane, American cavalrymen, to develop readiness for mounted close combat, employed a form of live tactical engagement simulation in which each participant was equipped with a blunt saber with a padded hilt, a face mask, and a helmet with a sprig of brush attached to its top; sides were formed, and clashed in a melee in which each combatant strove to whack off his opponents' top-knots. (Cf. Jackson, 1970.) However, the word "simulation" was not used to describe such training in the Army of one hundred years ago, for that term then conveyed the sense of its Latin root, the infinitive *simulare*, by which the Romans meant "to feign, to deceive, to fake." Early in the mobilizations for World War I, and again in World War II, Army trainers had to improvise to redress abject military unpreparedness. Lacking as they did real ordnance, the only way they could conduct training was with wooden mockups of weapons, to substitute trucks for tanks, or to hypothesize the existence of other capabilities. For most of this century, "simulation" has been a term applied invidiously within the Army to any training involving a simulacrum of military equipment, or pretended movement, shooting, or communications. The Army of World War II —the Army of George C. Marshall and Leslie J. McNair— rejected simulation and held as a matter of faith that effective training for war required real equipment, maneuvers by large units, and preferably, shooting live ammunition. (Cf. FM 105-5, 1973; Collins, 1978.)

In the mid '70s TRADOC's training developers reached beyond the Army's abhorrence of simulation and with the assistance of the Army Research Institute for the Social and Behavioral Sciences (ARI) acted upon the inferences from combat developers. Forms of constructive and live tactical engagement simulation (TES) in use in combat developments were simplified, reduced in cost, and made available to the Army at large to support individual and collective tactical training in units. In the late '70s, TRADOC fielded the Multiple Integrated Laser Engagement System (MILES, a play on Latin for "soldier"), and helped in the early '80s to man and equip Fort Irwin, California, the first of the Army's Combat Training Centers (CTC). During the same years, TRADOC fielded a number of "battle simulations"—constructive TES, modernized *Kriegsspiel*, based on map boards or computers—for training in interactions among weapon systems, or command, control, and communications. Further, TRADOC scrapped the "factory system" of time-managed unit training, substituting guidelines stressing mission analysis, and training oriented on outcomes, expressed as tasks, conditions and standards. TRADOC held that what mattered in any training was mission relevance and quality of performance, not perfunctory adherence to a subject-hour schedule. TES was readily the Quality Imperative adaptable for most tactical missions, necessitated performance in the field, and aided assessment of training effectiveness.

Inculcating Engagement Simulation and the After Action Review

Throughout the 70s, the TRADOC and ARI evaluated TES as a way to teach tactical behavior. TES can be described as experiential learning for teamwork in combat, each two-sided engagement culminating in a frank, all-ranks After Action Review (AAR). Both TES and the AAR certainly constituted a distinct departure from training norms in the U.S. Army. Prior to TRADOC's thrust into TES, free-play, force-on-force interactions were rare in Army training, casualties were seldom assessed, and tactics were taught mainly as process: prescribed formations for movement or specific procedures for given circumstances. Training emphasis was from the top down; primary focus was on the performance of large units. Judgment of tactical proficiency was considered to be the sole prerogative of the senior officer present; he alone had the right to criticize performance, and he had the obligation to do so in a way that would not diminish any leader in the eyes of those he led. Training of this ilk benefited mainly the small percentage of participants concerned with larger-unit performance as opposed to the small-unit tactical performances crucial to success in actual combat. "Ace" Collins (1978) had it right:

Over the years, observing exercises has led me to the following rule of thumb: The benefit from a field-training exercise extends to units two levels below the highest headquarters participating. In a company-level exercise, the platoons, squads, tank crews, and gun sections derive the most benefit; a battalion exercise benefits the battalion and company level; and so on. (p. 147)

In contrast, free-play TES, properly conducted, engaged participants in the critique from the do-it level upwards and turned the mid-century Army training paradigm on its head. That fact was not always well received, since frequently TES resulted in embarrassing defeats for command groups that had thought well of themselves before the exercise. The bottom-up search for what went right and wrong, and why, that characterized AARs clashed directly with Army mores. As one general put it:

No other army in the world exposes its unit chain of command to a no holds barred 'battle' against an OPFOR controlled by another chain of command where if you 'fail' as a leader it is evident in exquisite detail to your soldiers . . . No Army—including the Israeli Defense Force— has dared to do this. (Chapman, 1992, pp. 103-104)

Experience in TRADOC and various troops commands established that TES, conducted with its intended educational rigor, led to very significant improvements in individual and collective effectiveness, measured against varied baselines by a wide range of indices: qualitative and quantitative evidence of a dramatically superior training methodology (NATO TP/3, 1992; TN/5, 1993). TES could, of course, be misused. (Cf. Wilson, 1989: 180-184, 251-252.) But favorable evaluations underwrote substantial Army investments in additional TES hardware and software, the establishment of two additional Combat Training Centers, the inauguration of TRADOC's Battle Command Training Program (BCTP) to train division and corps commanders and staffs throughout the Army, and issuance of the Brigade/Battalion Battle Simulation (BBS).

TES as Driver for Doctrine

ARI has shown a clear relationship between a unit's performance at Fort Irwin, the National Training Center (NTC), and the unit's adherence to TRADOC's training doctrine in its preparatory training at home station. The criteria were battle outcomes for those units in TES at the NTC and five of the Army's Principles of Training: (FM 25-101, 1990: 1-3 to 1-8)

1. Train as a Combined Arms and Services Team
2. Train as You Fight
3. Use Performance-Oriented Training
4. Train to Sustain Proficiency
5. Train to Maintain

Table 1.1 Application of the Principles of Training

Principle	Bde 1	Bde 2	Bde 3	Bde 4	Bde 5	Bde 6	Bde 7
1	H	H	M	M	L	M	L
2	H	M	H	M	M	L	L
3	M	H	H	M	L	M	M
4	H	H	M	M	L	L	L
5	H	L	M	L	M	L	M
TES WINS	5	3	2	2	1	1	0

H==High level of application of Principles, M=Moderate, and L=Low

The ARI report concludes unequivocally that "higher levels of application of the Principles of Training found in current Army doctrine leads to better performance at the NTC" (Holz, et al, 1994, p. 76). TES seeks to make training a reasonable approximation of combat and thereby provide a surrogate for bloody battle learning such as took place at Cantigny. The performance of the Army's divisions during Desert Storm, Iraq-Kuwait, 1991, was an acid test of TES-based training [the National Research Council's committee on enhancement of human performance examined TES and the NTC, and deemed these a significant example of adult learning successful in transfer to a real, wartime task. (Druckman, Bjork et al., 1994). Afterwards, many general

officers who served in divisions during the Gulf War cited experience at the NTC as a major factor in their victories. Here is one such statement, from an officer uniquely well positioned to form judgment (Carter, 1992):

I believe that the NTC contributed more to the victory than just how to "move, shoot, and communicate" in the desert. The NTC was the instrument for all fundamental change for all Army training and doctrine because:

—it made us execute tasks to explicit standards against an uncompromising and tough enemy.

—it was the wake-up call that our home station training was not rigorous enough.

—most importantly, the NTC institutionalized the After Action Review Process at all Army levels so that it is now routine to provide totally honest, candid and detailed discussion with all participants to go over what worked and what didn't so that all could share, learn, and do better next time. The AAR process in essence made us intellectually honest. This combination, working dynamically over the last 10 years, created the environment for the professional preparation for war. We knew our strengths and weaknesses, and we knew how to train in the time available to leverage the former and minimize the latter. The NTC mindset in the heads of the leaders from squad leader to general was the catalyst for victory. (Interview)

The Battle of 73 Easting

A prime example of resultant competence and confidence in combat was provided during the Army's "first battle" in Iraq (Scales, 1993). The initial engagement between advancing U.S. units and Saddam Hussein's elite Tawalkana Republican Guards Division was fought amid a sandstorm at Iraq's counterpart to Fort Irwin, the Guards' maneuver area and firing range southwest of Baghdad. Three troops of the U.S. 2d Armored Cavalry Regiment, covering the advance of the Third Armored Division, crashed unexpectedly into a brigade of the Tawalkana dug-in on its own training ground. The U.S. cavalry squadron commander had informed his troops that he expected enemy contact, but transmitted no more specific information. He ordered his lead troop, with nine Abrams tanks and a dozen Bradley fighting vehicles, to advance only so far as the GPS locator "73 Easting," there to halt and await further orders. (GPS is Global Positioning System, satellite-based devices for establishing geo-location. The troops had no maps, as such, and were ignorant of the existence of the Iraqi training center to their front and of other important terrain features, such as a road crossing their axis of advance). The lead troop commander, in a tank whirring over the sands at thirty miles an hour, navigated toward that stop line. As he topped a sandy ridge, his thermal sight glowed with spots indicating eight Iraqi tanks to his immediate front. Without hesitation, he commanded his tank crew to fire on the move: his gunner and loader destroyed three Soviet-made T-72 tanks in ten seconds. With well practiced ease, the other eight tanks of the troop, most of them commanded by sergeants, came abreast from wedge formation and joined in the shooting, demolishing the other five T-72s. By then more targets had appeared in sights, and the onrushing M-1s and BFVs engaged these as they appeared. Advancing at twenty miles an hour, the troop cut a swath 3 miles wide and 5 miles deep through the Tawalkana defenses, destroying 28 tanks, 16 armored personnel carriers, and 39 trucks without sustaining a single US casualty. The only other recorded clear win among

America's "first battles" followed upon a comparable charge by another captain leading a troop of the 2d Cavalry at the Battle of Resaca de la Palma, 9 May 1846 (Bauer, 1986).

One year later, participants in the Battle of 73 Easting, as it came to be called, were brought together to assist Army historians in understanding what had happened. A general present noted that, among the cavalymen at the outset of the battle, there had been not one combat veteran. Pointing out that in the past the Army's "first battles" had been marred by mediocre tactical performance, he asked how the cavalymen explained their overwhelming success. The answer was quick and sure:

Sir, this was not our first battle. This was our 15th battle! We fought 3 wars at the NTC ... we fought 4 wars at the Combat Maneuver Training Center (CMTC) Hohenfels, Germany; and a lot of other simulations like SIMNET . . . Yes sir, we had been "shot at" before. Many times. This war was just like our training. (Interview)

In May, 1992, the lead troop commander, testifying before the Senate Armed Services Committee, was asked why he had not complied with orders to halt at 73 Easting. He replied that he had been through NTC battles with three different units, the first time in 1982 as a USMA Cadet. One lesson that he had learned there was that the tactical commander on the scene must exercise his own judgment on how best to accomplish the intent of his commander, even if that meant acting contrary to order. Another lesson, he said, was that any force with the advantage of surprise could fight outnumbered and win, but only so long as it maintained its momentum (McMaster, 1992). What the captain was attesting is that the concept of TRADOC was essentially right. TRADOC's combat and training developments suffused the Battle of 73 Easting.

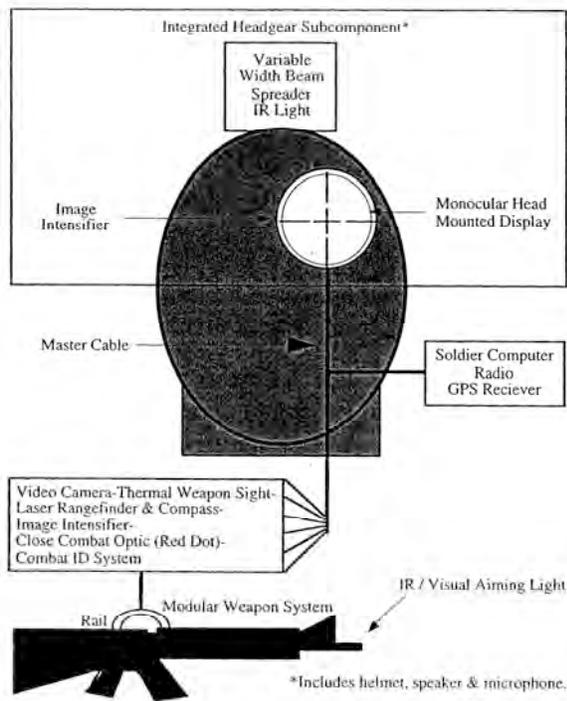
TES for the Future

In the late '80s, TRADOC aided the migration into the Army from the Defense Advanced Research Projects Agency of SIMNET, a developmental, mounted warfare simulation based on a network of manned simulators, each incorporating a powerful processor. SIMNET enables Distributed Interactive Simulation, TES among vehicle crews separated by distances limited only by available communications. Referred to as virtual TES, in that its synthetic, computer-generated battle environment and mock-up fighting vehicles are apparently real to participating soldiers, SIMNET is evolving toward the Combined Arms Tactical Trainer (CATT). CATT is expected to exert powerful leverage on change for Force XXI, in that it will enable graceful interaction among the three forms of TES —live, constructive, and virtual— will do so without regard for the locus of participants, and will support introduction of novel weapon systems and doctrinal concepts.

TES originated at the U.S. Army Infantry School, Fort Benning, Georgia. Today, in the Infantry Training Brigade located at Fort Benning, TRADOC conducts initial entry training for all four basic infantry specialties. The training is elegantly designed and well executed: each soldier's performance is individually observed and assessed, and he is placed in groups paced to overcome detected weakness or to exploit demonstrated strengths (Steele, 1995). His training culminates in the field, in a graduation exercise with live tactical engagement simulation. On the

March, 1995, cover of Army magazine, there is a photograph of one of Benning's apprentice infantrymen — face camouflaged, helmet ringed with MILES laser detectors— a portrait of progress in Army training. Evident progress should mislead no one into believing that status quo will be good enough for training that soldier's successor in Force XXI. In research and development now, in 1995, are no less than three waves of infantry-specific materiel, new systems designed to enhance the capability of the individual combatant based upon current thrusts in information technology. In the near term, the present rifle will be upgraded with a rail-like adapter permitting it to be fired aided by up to four modular fire control devices chosen from a dozen or so: e.g., thermal imaging sight, laser range finder, laser designator, or optical sight; each infantryman selects devices for each mission. Also, each mechanized infantry squad will be issued one or two 49-pound Javelin antitank missile systems, replacing the 75-pound Dragon system. (On Javelin the infantryman can switch the detachable Command Launch Unit to either a day or night sight, with an option on the latter for wide or narrow field of view, and he must choose between top attack and direct attack of his target; the gunner's tasks are formidable: the check list for engagement contains, depending on his selections, 15 to 25 steps.)

Fig.1.1 Land Warrior Digitization



Around the turn of the century, two successive "Land Warrior" programs will issue computers and heads-up displays, and individual radios and video cameras.

By 2010, the modular weapon system will have been replaced by the Objective Infantry Combat Weapon (OICW), designed to be aligned on target through the Helmet Mounted Display, and to deliver, at each soldier's choice, either direct fire (e.g., 5.56-mm kinetic energy rounds) or indirect fire (e.g., 20-mm air-bursting projectile).

In the calendar below, note the rapid progression envisioned for information systems (Versions I, II, III): thermal sights, radios, displays and video cameras. Between now and 2010, each infantryman will also be equipped with improved body armor, and a medical monitoring system with its own signaling and geo-positioning.

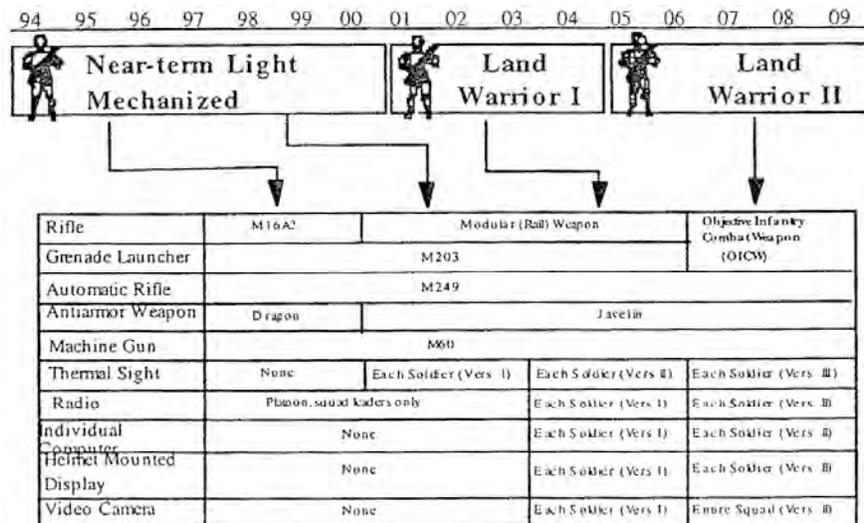


Fig. 1.2 Infantry of the Information Age

Facing the Future

What sort of soldier will the Army have to recruit to fill the ranks of the infantry battalions of Force XXI? How should that soldier be trained? I submit that answering the first question may be easier than answering the second. Preferably, that soldier should be recruited from young males who have completed high school, who are accustomed to learning by interpreting computer-generated symbols, and who have the physical strength, stamina and attitude compatible with membership in a small infantry team. Up until the present, an infantryman was seldom expected to deal with abstractions, but in the future, certainly before 2010, he will have to cope not only with the stressful environments of dismounted combat and with complicated choices concerning his weapons, but also with rich iconographic inputs, "situational awareness" signals from an elaborate, unprecedented command, control and intelligence system. This suggests to me games or virtual simulations that emulate tasks of responding appropriately to comparable stimuli under time constraints and their use in personnel selection and training of would-be infantrymen in Force XXI.

Training such a quality soldier once he joins Force XXI will present to TRADOC new challenges in that current training techniques and devices will clearly be inadequate. Taken together, the equipment that will be issued to an infantry squad by 2010 entails complex training beyond any heretofore essayed for American infantrymen. I do not sense that TRADOC has either a clear concept of how to tackle these complexities or the resources to do so even if they had a plan. Here is what TRADOC (1994) says about the task that lays ahead of it:

Soldiers . . . must receive initial training that ensures physical readiness, develops the right attitudes, and provides the skills needed to fight and survive in battle. They must be instilled with the soldier values, loyalty, discipline, toughness, courage and esprit. The soldiers must be able to perform to standard under adverse conditions both day and night, with basic equipment and advanced systems. Training must be hands on and live fire whenever possible. The individual soldier's equipment will be integrated into a fully modular system designed to increase his overall effectiveness on the battlefield. Future

combat soldiers will be able to defeat the enemy at greater engagement ranges, communicate at greater distances, survive extremely lethal threats and environments, be more effectively sustained, and be more effectively supported on deployment, (pp. 6-7)

What is missing from the foregoing is "shared idea," or "concept," or other terms conveying appreciation that, whatever gains may be realized in the individual soldier's combat effectiveness, what truly matters is how he contributes to that of his squad: his first duty is to join his force to others! In short, I am led to believe that emerging equipment aimed at optimizing the effectiveness of each individual soldier has not been accompanied either by combat development aimed at optimizing squad teamwork or by cogent training development with the same objective.

Information Age Equipment

For example, combat developers might have set a higher priority upon requirements for a graphic visualization of the relative position of each member of the squad, continuously updated, than for individual navigation displays. Combat developers might also have been concerned less with (relatively easy) means for raising the sensory acuity of each individual soldier than in enhancing the collective awareness of his team: e.g., treated the squad as a mobile array of sensors —audio, seismic, or thermal, functioning independent of bearers— so that outputs from the array could be analyzed to the rear and transmitted in graphic summary back to the squad, or used to direct the fire of supporting weapons. (The Advanced Research Projects Agency has a number of candidate sensors, but so far has not devised a means for positioning these where they could bear on close combat, or move to form a protective envelope of awareness around an advancing dismounted unit. A relevant project is termed "BRAVO," being pursued with the Dismounted Battlespace Battle Laboratory at Fort Benning, in which a DIS prototype of a robotic sensor platform designed to operate within an infantry squad will be subjected to military worth analyses.) Or, instead of a more powerful weapon for each soldier, combat developers might have sought new means for the squad to designate targets for supporting weapons or otherwise summon and direct firepower from the rear. Training developers have been no more imaginative: at this writing, the concept of embedded training for the Land Warrior systems is software presenting check lists and message formats plus a library of printed manuals. Not even equipment such as MILES for live TES is planned to be "embedded." The Operational Requirement Document for the Land Warrior specifies that:

Institutional and unit training for the target audience will emphasize operation and maintenance of the modular capabilities. Embedded training will be used to the maximum extent possible within program and system constraints. Training devices, if required, will be developed in sufficient time for concurrent testing and fielding with the system. (LW ORD, 1994: 10.)

Embedded training will be provided with the inclusion of electronic training manuals and field, operator, and technical manuals, along with first aid training. Training devices should be modified to interface with the LW system. The LW soldier must be provided the opportunity for marksmanship and battlefield skill enhancement where ranges and other resources are not available. Future developmental training systems such as the close combat tactical trainer should be targeted for LW interface as soon as possible. Mission rehearsals will be made possible through the capability of each squad

member to view pictures or computer/radio with embedded reference documents could provide the LW soldier information and assistance when needed. Additionally, this could raise his/her knowledge or skill level by giving him the capability to quickly learn and complete a wide variety of tasks. Soldiers can never be trained and kept fresh in all skills they might need, but they can be given the computer/radio that will permit them to gain easy access to on-the-spot training . . . (LW ORD, 1994: K-1-10,11)

The functionality of the soldier's computer/radio can be tailored for each soldier, so that presumably only leaders would upload most of the available applications shown in **Table 1.2. (right)** The Command & Control items are supposed to be interoperable with the Intervehicle Information System and comparable systems already in use. PLAYMAKER is a "whiteboard", permitting one infantryman to sketch a route or a tactical move while interacting with others. The METT-T Analysis planning aid (mission, enemy, terrain, troops, and time available) provides lists of equipment and supplies for particular missions.

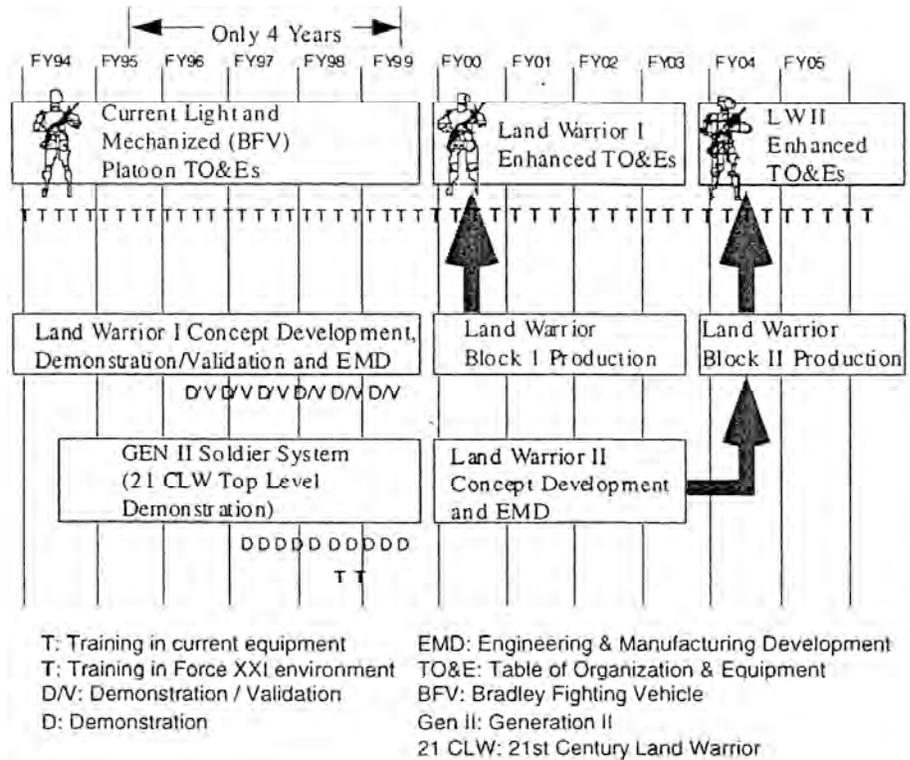
<p><u>Command & Control</u></p> <ul style="list-style-type: none"> -Reports <ul style="list-style-type: none"> -Spot (SALUTE) -Call for Fire -NBC -MEDIVAC -ACEW -GPS -Medical -Combat ID <p><u>Playmaker</u></p> <p><u>Messages</u></p> <ul style="list-style-type: none"> -Warning Order -Operation Order -Frag Order 	<p><u>Battlefield Status</u></p> <ul style="list-style-type: none"> -Maps -Overlays <ul style="list-style-type: none"> -Generate -Display -Waypoint Table -Azimuth <p><u>Mission Planning</u></p> <ul style="list-style-type: none"> -METT-T Analysis -Route Planning <p><u>Training (References)</u></p> <ul style="list-style-type: none"> -Combat Leader's Guide -Field Manuals -System Technical Manuals -Foreign Weapons
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Information Age Training

Training developers have yet to stipulate functional requirements for the training devices, simulations, and simulators that will be needed for the individual and collective skill training, for unit training for readiness, or for operational rehearsal as called for in the LW Requirements Document. This lacuna is the more disadvantageous because Army laboratories lack both virtual and constructive simulations for the oncoming equipment that will enable laboratory experimentation with form, fit, and function in the range of combat scenarios for which the equipment was designed: various conditions of light and terrain and the spectrum of possible missions and threats. The propensity will be, with each set of advanced equipment, to repeat the circumstances of the initial Advanced Technology Demonstration (ATD) for the Soldier Integrated Protective Ensemble (SIPE) in November, 1992: there being no simulators available, a two-day field evaluation of early prototypes took place, in which test subjects were individuals, not teams that had been trained together or tactical units. Some subjects felt awkward and uncomfortable in the new equipment, and some could not wear the key item, the headpiece, for more than an hour at a time. Nonetheless, the equipment was judged to have potential military worth (SIPE Reports, 1993). Courageously, the Army then invested tens of millions of dollars to engage contractors to produce better equipment for further demonstrations, but the evaluation of these upgrades will occur in an ATD later this year, some 32 months after the SIPE ATD. Ad interim, there has been comparatively little investment in simulation.

Land Warrior's lack of a simulation for RDT&E, and operational rehearsal is a grave shortfall. No matter how high the quality of soldier assigned to the infantry of Force XXI, no matter how uplifting the manuals injected into his computer for self-study, at this writing it has to be said that he is unlikely to master the individual skills or the teamwork he will need to be effective and to survive on tomorrow's battlefield. In short, if the infantrymen at Cantigny in 1918 suffered from inadequate training and a shortage of equipment, the infantrymen of Force XXI

face the real prospect of inadequate training and a plethora of equipment. **Fig. 1.3 (above)** The pace of the LW program is breathtaking; only four years from now. LW I will be issued, and eight years from now, LW II. These are short timelines for TRADOC's anticipatory action. Note that the plan calls for concurrent development and engineering, punctuated by advanced technology demonstrations and validations.



A Simulator for the Dismounted Combatant

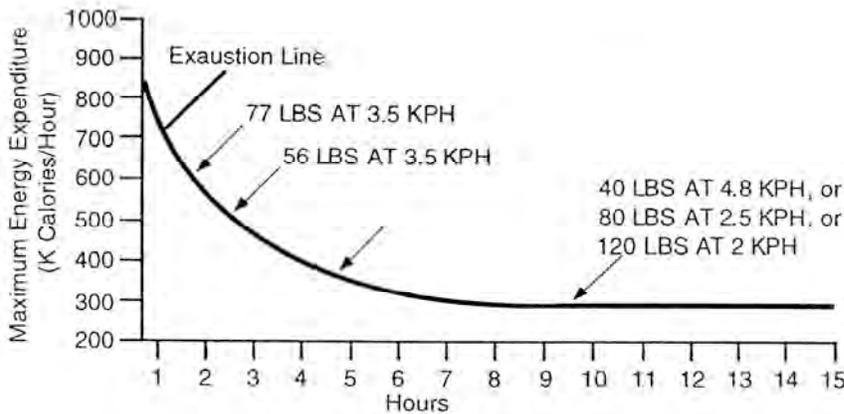
The Land Warrior developments will arrive in an Army that has no satisfactory means of inserting a dismounted individual into any simulation other than live field exercises. Yet simulation in all three forms could be useful during materiel development in validating LW requirements and in establishing military worth of the emerging components of the system. Virtual simulation would be particularly useful in assisting materiel developers and contractors through issues of form, fit, and function, chief among which will be keeping the infantryman's weight budget in balance. As the LW Operational Requirements Document (1994) observes, "The foot soldier's load has been steadily rising as a result of stovepiping new / improved items into the inventory without regard for the combined effect of this load on the soldier's fighting ability" (p. 2). Land Warrior aims to constrain total weight, but infantrymen will nonetheless be expected to carry unprecedented weight into combat. Moreover, neither the baseline nor the future weights take into account "unassigned" anti-tank weapons or extra ordnance, such as grenades for use in fighting through buildings (Roos, 1995).

Table 1.3 Soldier Loads, 1995 and 2010

	1995 (Baseline)		Future (2010)	
	Pounds	Percent	Pounds	Percent
Clothing & Equipment	29.7	34.2	35.4	39.4
Weapons / Ammunition	23.1	26.6	23.1	25.7
Radio-Optics	14.0	16.1	12.6	14.0
Food / Water	12.6	14.7	10.8	12.0
Ballistic Protection	3.5	4.0	3.52	3.9
NBC Protection	3.7	4.3	4.5	5.0
Total	86.8	100.0	89.9	100.0

"SLAM" Marshall, in the Soldier's Load and the Mobility of a Nation, held that combat load should not be more than 80% of the soldier's training load and that the latter should not exceed 33% of his body weight (Marshall, 1950). As **Table 1.3** attests, Soldier load will increase.

Fig. 1.4 Work Rate and Energy Expenditure



Today the Army has a somewhat more sophisticated construct, as **Figure 1.4** indicates (FM 21-18, 1990:5-1 to 5-13).

Like Marshall's rules of thumb, Army work rate and energy data make the point that there is an adverse effect of adding to the soldier's load to be traded off against assurance of performing mission. No doubt American scientists and engineers will work wonders with miniaturization and light composites in executing Land Warrior, but one of the central issues they face is how to achieve their goals without compromising the mobility of the soldier or his unit and without sacrificing their collective survivability and sustainability. When weight of the individual combatant's clothing, equipment, ammunition, and rations exceeds 40 pounds, leaders must expect, for every 10 pounds of excess, decreases of 2 km in the distance traveled in a 6-hour approach march; they must appreciate that time over an assault course will increase by 15% for every 10 pounds he carries in excess of 40 pounds; and they must understand that speed of soldiers advancing up slopes above 10% gradient will be reduced by 50% for every 10 extra pounds.

Dismounted combat is hard work; exhausted soldiers are not only less effective, but more careless, and therefore more likely to become a casualty. Clearly, before deciding on the production configuration of Land Warrior equipment, extensive experimentation with soldier loads is mandatory and could preferably take place on simulators capable of portraying all the variations of light, weather, and trafficability. Once the Land Warrior II equipment is issued to Force XXI, simulations must be available to train troops to use that equipment to maximum

advantage. However desirable it may be to conduct training that is "hands-on and live fire," Force XXI is unlikely to have the requisite land, personnel, equipment, ranges, or ammunition—either in its institutions or in its units—for the individual and collective training of the modernized infantryman. Even were optimum facilities available, live-fire training of an infantry unit for its missions against a range of threats in varying conditions of light and terrain, including built-up areas, would be hazardous, difficult to arrange, and expensive. Preferably, training developers will devise virtual simulations to generate conditions and threats so that infantry tasks may be trained hands-on and trained to mastery of individual equipment and of key teamwork skills before progressing to live TES or to live-fire exercises.

The Friendly Fire Problem

TRADOC must find a way through combat developments and training developments to eliminate fratricide in Force XXI. TRADOC should aim to provide each division in Force XXI the means to conduct rigorous tactical engagement simulation within its own resources, whether at home station, at a CTC, or deployed abroad, for the purpose of developing and maintaining its tactical skills and teamwork. These should be interoperable with virtual TES, such as CATT. Preferably, training devices for this purpose would be embedded in combat equipment, and would be integrated with IFF means to eliminate, or to reduce significantly, friendly fire incidents—sometimes referred to as fratricide, amicide, or amicicide. Fratricide presents a clear and present problem for TRADOC's combat developers and training developers. It is also an issue that profoundly affects public perception of the Army and therefore is highly germane to recruiting and retaining quality soldiers. Recent estimates, although drawn from inconsistent and fragmentary records, but adjusted to TRADOC's definition of what constitutes casualties from "friendly fire," depict the problem's persistence over the past century, and suggest that it may, in fact, have increased over time (Steinweg, 1995).

Table 1.4 Fratricide Rates

War	Fratricide Rate
World War I	10% of WIA
World War II	12% of WIA; 16% of KIA
Korea	7% of all casualties
Vietnam	11 to 14% of all casualties
Panama (Just Cause)	5 to 12% of WIA; 13% of KIA
Persian Gulf (Desert Storm)	15% of WIA; 24% of KIA

George C. Marshall, who planned and supervised the attack at Cantigny, was well aware of the hazards of friendly fire. To insure that the 1st Division's artillery could remain informed of the exact position of the 28th Infantry's forward elements, Marshall caused pole-mounted signal panels to be carried by rifle elements in the attack, to be displayed for French observation aircraft detailed to fly periodically over the lines. (The author has a copy of an aerial photograph from the National Archives showing a signal in use.) When Marshall was Assistant Commandant at the Infantry School, he sponsored a seminal book on tactics, Infantry in Battle, first published in 1934, within which there is a chapter enjoining "intelligent and unremitting efforts" to forge an

infantry-artillery team that could avoid the latter's firing on the former. One combat example cited was the attack at Soissons, July 18, 1918, when the U.S. 1st and 2d Divisions drove six miles into German defenses, but sustained over 12,000 casualties; the 1st Division's 26th Infantry came out of that battle with less than 10% of its starting strength (Millet, 1986). The 1st Division artillery had problems maintaining effective liaison with the advancing infantry:

At 4:35 the batteries opened. No caterpillar rockets were seen, so the artillery concluded it was not firing short . . . The artillery brigade commander was completely in error as to the location of the front-line infantry. It is obvious that unless the artillery knows the infantry's location it is going to hesitate to fire. Yet despite this natural reluctance, it is only necessary to read the personal experiences of front-line infantry leaders to realize that all too frequently artillery does fire on its own troops. In fact. General Percin, of the French Army, estimates that 75,000 French casualties were caused by French artillery during the last war. American artillery frequently faced the same indictment. (Harding et al., 1939, pp. 256-258)

Both the Germans and the British had similar experiences (e.g., Lord Moran, 1968). Recent data from the CTC instrumentation on fratricide have been consistent in showing the need for ameliorative action. Among mounted units at the NTC, "casualties" from friendly fire range from 5.6% of all casualties during deliberate defense to 25.4% of "casualties" incurred during deliberate attacks; the average for all operations has been 11%. Among dismounted units at the Joint Readiness Training Center (JRTC), although artillery accounts for only 34% of recorded firing events, it occasions 75% of all instances of "fratricide."

TES for Force XXI

The foregoing discussion has used the Cantigny paradigm to focus largely on infantry, but the implications of digitization in Force XXI extend across the combat arms. TRADOC should launch comparable initiatives in combat and training developments for every soldier whose mission includes close combat, dismounted or mounted, on the ground or in the air. More is entailed than upgrades of the existing CTC. TRADOC ought to have long since established requirements for an entirely new generation of TES equipment for live, virtual, and constructive simulation. That equipment should provide:

- 1.) For virtual TES, I-Port, an individual combatant's portal into Distributed Interactive Simulation (DIS). To project a dismounted combatant into a synthetic battlefield for combined arms operations against a thinking foe, and to engage that combatant's digitized systems for intra-squad teamwork, situational awareness, reconnaissance, reporting, and target engagement, TRADOC ought to state a requirement for one or several motion platforms appropriate to his walking, running, or crawling, coupled with audio-visual stimuli derived from the computer-generated environment, and other military objects under DIS management. Further, since one individual combatant requires ten times the computer power necessary for depicting a tank, and since foot soldiers need high definition terrain in that they can find cover and concealment in minor folds of ground, I-Port presents formidable computational challenges that must be overcome by R&D.

2.) For live TES, fully computational TES instrumentation. The range and celerity of modern weapon systems, especially the "fire-and-forget weapons," e.g. HELLFIRE, LONGBOW, JAVELIN, now render difficult using eye-safe lasers of the MILES sort for emulation of engagement events (Holz et al, 1994). Further investments in laser-based emulators or in conventional range measuring systems, must be weighed against the prospect of combining the TES requirement with that for the Identification Friend or Foe (IFF) system, since both should encompass absolute and relative weapon system position, aiming, and projected impact point, and should capture data from each system's own sensors and fire control processors. Given advances in geo-positioning combining satellite signals, digital maps, and other techniques, it appears feasible to generate DIS-compatible data units from each militarily significant object on a TES battlefield and to communicate wirelessly descriptions of all weapon systems interactions between or among such objects within DIS-compliant software executing physics-derived models (Goblick, et al, 1995). These data will enable, for the first time, explicit analyses of how well training performance maps into combat prowess. Preferably, all capabilities for TES would be incorporated into the weapon system itself—vice the strap-on approach adopted for MILES—so that a deploying unit could take its TES gear along without weight and cube penalties and so that, whether at home station or in a theater of war, the unit could train as it fights and fight as it trains.

3.) For constructive TES, validated models must be devised for individual combatants, especially for Operations Other Than War, and for Military Operations in Built-up Areas. The general dearth of reliable data for models of dismounted combat may be remedied with that collected from live or virtual TES. The preferred form of constructive models should be DIS-compatible Semi-Automated Forces (SAFOR), capable of interacting with virtual or live TES. Every effort should be expended to inform models with empirical data collected from live TES instrumentation during actual (combat) operations, as well as from live or virtual TES, and from operational tests and evaluation of materiel. Clearly, iterative long-term development should be anticipated.

4.) For all three forms of TES, full interoperability, and the communications to support DIS networks throughout Force XXI. DIS could then support not only unit and institutional training, but also individual and collective training, operational rehearsal, training development and combat development, and research, development, test and evaluation: The capability to interconnect virtual like and constructive simulations for unit training across the full range of military operations will be necessary and must be embedded in our equipment. (TRADOC, Pam 525-5, 1994: 4-3)

Distributed Learning TRADOC seems to know what must be done: Pamphlet 525-5, published in August, 1994, encourages me to believe that its strategic vision is unimpaired. But I am concerned that TRADOC is unlikely to have sufficient resources, especially the human wherewithal, to act well and in time. The present Chief of Staff, General Sullivan, in his letter transmitting Pamphlet 525-5, called for a re-valuation of TRADOC's Table of Distribution and Allowances (TDA), documentation of Department of the Army decisions on allocation of resources: While the majority of the text focuses on the operational part of the Army, do not be misled. The operational environment that 525-5 describes has clear implications for the remainder of the Army. We cannot fight the way that 5-525 envisions without changing how we

organize, train, mobilize, project, and sustain the force. The responsibility for these functions all reside in the institutional, or TDA, Army. So, when you think about, analyze, and debate the merits of the text, do not forget to consider those points in the context of the larger Army of which we are all a part. (TRADOC, Pam 525-5, 1994: 4-3) As I see it, the trouble is that, from decisions faintly reminiscent of selling off wagons in 1895, TRADOC, in complying with cuts in its TDA, may have compromised its ability to prepare the Army for Force XXI. I was told by an authority on such matters that when TRADOC's personnel authorizations and funds were reduced sharply to meet Army "right-sizing," the command decided to focus its diminishing resources on what it construed as its core mission: institutional training for the Army. To preserve "quality," TRADOC-directed school commandants to maintain instructor-student ratios, if need be at the expense of combat developments and training developments. Then, apparently because more personnel than anticipated elected to leave voluntarily. Army-wide requirements for replacements unexpectedly went up, meaning higher targets for recruiters and increased student-load in TRADOC. It now seems virtually certain that TRADOC will have most of its talent committed to instructing the current force, as opposed to pursuing combat developments and training developments for Force XXI.

What is TRADOC? A few generalizations about TRADOC prior to its current dilemma are in order:

1.) TRADOC was formed around the Army's school system, and continues to serve the Army as its institutional trainer. But from its inception, it has also made a major modern contribution to readiness in combat units, especially through training developments.

2.) Combat developments, from the outset TRADOC's other major undertaking, endowed the Army's schools with analytical rigor and, by acting as the surrogate for the fighting force in stating materiel requirements, insured that acquisition decisions were taken consciously considering each element of DTLOMS.

3.) In both combat and training developments, TRADOC provided an unprecedented and functionally indispensable interface with troop commands, such as Forces Command and U.S. Army Europe, the Development and Readiness Command (now the Army Materiel Command), and behavioral experts (such as those in ARI, the Institute for Defense Analyses, and the Human Resources Research Organization).

4.) TRADOC has actualized "doctrine" through digital media. Combat developments led to cogent training developments, providing the current force with TES, an information-age mechanism for building consensus on how to behave in battle, and for infusing TRADOC's tactical precepts into the force, that has been demonstrably more powerful than school-house harangues or the written word.

5.) TRADOC has probably figured in recruiting and retaining quality soldiers because Army equipment has lost its klutzy "GI" public image of yesteryear, and its training is acknowledged to aim at mastery and to challenge soldiers, physically, mentally, and emotionally. In public perception, America's Army has new style, new capability, and new confidence that have been evident both in simulated combat at the CTC and in actual battle. (One of the leaders of the Congressional delegation sent to Panama in the aftermath of JUST CAUSE

called the author in the middle of the night to report that uniformly the soldiers he had interviewed on the scene judged the invasion as less arduous than their training.) As budgets tighten, and the gap widens between demands for personnel and numbers available, there probably will be further proposals to shave TRADOC's TDA or to lop off its superstructure by shutting down TRADOC's four-star headquarters, returning the Army to something resembling status quo ante 1973: a Continental Army Command responsible for both institutional and unit training within the contiguous forty-eight states. If, however, the Army wishes to build upon its success over the past two decades in fielding battle-worthy divisions and in accessing, training, and retaining quality volunteers, it will preserve TRADOC as a command and task it to look ahead to Force XXI. This is not to say that TRADOC should be augmented at the expense of other parts of the Army. I hold that divisions in a high state of readiness ought to remain the Army's first consideration. But I believe that, without significant revision of TRADOC's TDA that command will be ineffective in many of its missions, including and especially laying the groundwork for Force XXI. That transformation will necessitate, however, making hamburger of one of the Army's sacred cows: that professional military education occurs during periodic sabbaticals from the force for resident institutional training.

Selling the Sacred Cow to Buy the Future

TRADOC institutional training is one relic of the Indian Fighting Army that has flourished in the 20th Century. Ingrained in most modern military professionals is worshipful awe for formal schooling and classroom finesse. In May, 1945, after VE Day, General Eisenhower wrote to General Pershing, referring to the Schools of Infantry, Artillery, Cavalry, and the Command and General Staff College, that "the stamp of Benning, Sill, Riley and Leavenworth is on every American battle in Europe and Africa" (Nenninger, 1974: 336-339).

Among the author's notes from his course at Leavenworth in 1961-1962 is a record of the number of times one of his peers incorporated institutional training into his solution to the problem posed by the faculty; in general, anytime a student reasonably could propose formal schooling, he did so. TRADOC Pamphlet 525-5 identifies three "pillars" for the Army training system: "institutional, unit, and self-development." Education for non-commissioned and commissioned officers alike now includes basic and advanced courses in branch of service; sergeants major have their own school; and selected officers proceed through staff and war colleges. In these schools—all, except the War College, run by TRADOC—there are specially designed classrooms, auditoriums, and libraries, and a dedicated faculty, executing a carefully considered curriculum, typically of six to nine months duration. Each school also fosters an atmosphere conducive to professional socialization. Ideally, instruction proceeds in small groups in which each student must daily demonstrate his or her mettle to peers and faculty. Practical exercises are frequent and lectures for large audiences relatively rare. The Army has been prepared to set aside as much as one-third of an officer's career for such schooling, either as a student or serving on faculty or school staff, and to bear the cost of moving the officer (and household) to and from school assignments. Reservists are offered non-resident programs (correspondence courses, for the most part) presumably based on the resident curriculum. TRADOC's institutional training is expensive, but efficient. It is demonstrably one of the more effective school systems in the United States, and no other profession in this country has been prepared to make a comparable investment in continuing education for its practitioners. During

President Carter's Administration, the Office of Management and Budget, with a view to cutting expenditures, conducted an inquiry into the Army's training system, targeting in particular its professional military education (PME). As I remember it, that review was notable chiefly for establishing that two-thirds or more of the funds appropriated for PME actually were spent on facilities —heat, light, building maintenance and repair, snow removal, blue collar labor, and the like— and that, despite TRADOC's willingness to economize by consolidating schools, the Administration was not prepared to pursue the requisite Congressional approval for base closures and realignments. Congressional interest in the years since has tended to question whether, in the interests of inculcating jointness, the Army needs more, not less, PME (e.g., H.A.S.C. 37 No. 100-125, 1990). Neither line of inquiry is likely to illuminate the choices facing TRADOC for training Force XXI. For Force XXI, the proper question is less the cost than the relevance of traditional "institutional training." Should not a digitizing Army seek to conduct its institutional training using methods and means congruent with those with which it intends to conduct sustained operations on land? If the Army accepts its own rhetoric and wants to train the way it will fight and fight the way it trains, the Chief of Staff ought to direct TRADOC to digitize, to supplement traditional institutional training with digitally distributed, digitally presented learning. His intent would be threefold: First, deliberately to increase the numbers of students per instructor so that some faculty can be diverted to combat and training developments. Second, to unburden TRADOC from physical plant and property, and with the cost avoidance to underwrite developments for Force XXI. Third, to furnish individual training comparable in substance, format, and effectiveness to both the Active and Reserve Components. To the degree that TRADOC can thus decrease Permanent Changes of Station for the Army's officers and noncommissioned officers, and lower the Army's full-time student accounts, to that degree it may underwrite its TDA shortfalls, and be able to influence directly and benignly the recruiting and retention of quality soldiers. Again, Pamphlet 525-5 indicates to me that TRADOC wants to attack the proper objective:

. . . We will examine and modify the current mix of institutional and unit training. This will impact the total Army and result in modified mobilization strategies...This will lead to the merging of individual, unit and self development parts into the seamless Army training system ...The number of installations on which traditional institutional training takes place will decrease, as will the number of installations on which major (battalion level and above) field exercises will occur. However these installations will be internetted and interconnected to facilitate both individual and collective training at all levels ... It will be a classroom without walls.

In 1992 the National Research Council published a report entitled Strategic Technologies For the Army of the Twenty-first Century that forecast the advent of efficient computer-based instructional techniques and recommended a new thrust in training developments:

The Army already has a strong core capability in training technologies; it is appropriately positioned to participate in this field. However, it should bring together its equipment, design, and human factor engineers to work more closely as a team . . . (STAR 21, 1992: 96-100)

STAR 21's recommendations are similar to those of Martin Binkin in Marching Toward the 21st Century, who, to assure that future soldiers could master complicated future equipment, recommended to the Army combat developments (my term) to improve weapon system reliability and maintainability, and training developments (my term) to exploit training technologies. As Binkin (1994) puts it:

Standing in sharp contrast to the growing influence of high technology on military weapon systems is the relatively meager impact on the support infrastructure and the training base in particular.

Research has indicated that advanced computer-based instruction in secondary schools and colleges has substantially increased the effectiveness of training (as measured by final exam scores) While the military, too, has adopted computer-based instruction in many of its training programs, critics have contended these new techniques have generally been applied to reduce the length of training courses (and hence training costs) rather than produce a more effective graduate. This has happened because the military has used these tools to produce an equally effective performer in less time, while secondary schools and colleges have used it to increase student achievement in a fixed period of time.

Recent developments in microprocessor based instructional systems are expanding the computer's capabilities as a sophisticated teaching aid, but the military appears to be lagging in this technology. The principal exception appears to be in simulator technology, which the armed forces have employed increasingly to conduct more realistic operational training with greater efficiency. The use of simulators in maintenance training, however, has not proceeded apace, prompting suggestions that the military services "piggy-back" on revolutionary developments in the private sector, finding their own special applications and creating the software and courseware particular to its needs, (pp. 183)

Creating software and courseware requires time, money and competent personnel—resources that, if TRADOC ever possessed them, are no longer in place. TRADOC attempted a large program of individualized instruction in its institutional training in the '70s and early '80s, but that failed for four reasons:

- (1) lowered quality of soldiers because of inaccurately screened recruits;
- (2) methods for instructional system design were then inordinately expensive and slow;
- (3) computers, computer interfaces, communications, and other components of instructional delivery systems were then costly and ineffective; and
- (4) as stated above, gains in learning effectiveness were applied to reduce length of course (reduce student load) rather than to increase numbers of tasks trained, to inculcate military ethics, or to assure higher proficiency.

In sum, these shortcomings elicited complaints from the force that TRADOC's graduates were undertrained (too much individual training relegated to the unit) and ill disciplined (inadequate military socialization). TRADOC will probably have to generate from within its present TDA the capital investments for new starts with training developments and combat developments. But as was the case with the rifle squad at mid-century, concept is more important than resources. Here TRADOC may find Pam 525-5's three "pillars" of training less useful than its original paradigm of the four training regimes dictated by the differences between training for an individual and that for a collective (e.g., crew, squad, platoon, battle staff), and the wide gap that has persisted between the effectiveness of training situated in an institution, and that in a

		<i>Where Army Training Occurs</i>	
		Institution	Unit
<i>Who is Being Trained</i>	Individual	I	II
	Collective	III	IV

unit. In this construct, training centers, branch schools and the staff college are in regime I, institutional training for individuals. CTC are in regime III, institutional training for collectives (yes, the NTC was originally conceived as a TRADOC school, still has there a TRADOC faculty in the form of observer-controllers, and has a curriculum—the substance and pace of tactical missions assigned to each unit). For Force XXI,

Table 1.5 Army Training

TRADOC ought to divert resources from regime I to develop ways to upgrade II, III, and IV, and to enhance its contributions to the self-development of Army personnel wherever they may be, on-duty or off.

As was the case in the '70s, diversions from regime I will raise a pivotal issue for training developments concerning initial entry training. The formulation in Pamphlet 525-5 is cogent:

Soldiers in the twenty-first century will be trained on selected critical individual tasks in initial entry training to ensure that they are immediately deployable upon joining their first unit. They will be familiar with the wide variety of tasks expected of them and the equipment they will use. This concept seeks to empower and develop the untapped potential of our quality soldiers. The battlefield contribution of individual quality soldiers will continue to increase and, indeed, is the root of knowledge-based operations.

However, TRADOC ought to find it possible, as a function of increased computer literacy in American society, to develop pre-enlistment selection and training courses that could augment individualization of instruction in initial entry training and thereby guarantee sending forth soldiers both well-adjusted to Army mores and standards and competent in their chosen

occupational specialties. Moreover, in the information age a substantial leveraging of self-development both before and after initial entry training ought to be relatively easy.

For example, suppose TRADOC were to propose revising dramatically the current training technology of Junior ROTC (JROTC). General Colin Powell, as Chairman of the Joint Chiefs of Staff, strongly supported JROTC as "the best opportunity for the Department of Defense to make a positive impact on the nation's youth." In 1995, that program will cost the Department of Defense over \$150,000,000, supporting detachments in 2,267 secondary schools around the country; each detachment consisting, on the average, of 136 cadets. Congress has authorized expansion to 3500 detachments, and a budget of some \$240,000,000 (McCarthy, 1995:C9). The Army's JROTC detachments, administered through TRADOC's Cadet Command, now number 1,242, but are expected to reach 1,400 next fall, with a budget then approaching \$100,000,000 per annum. The backbone of Army JROTC is training right out of 1895: rifles, trinket-laden uniforms, drill and ceremonies, plus a modicum of physical fitness. Critics, of course, are quick to point out that the program has not shown how it affects college enrollments or employment potential, and that JROTC obligates a host school to cost sharing, draining resources that might help deprived youngsters to qualify for higher education or to earn a living. TRADOC could propose that some or all Army JROTC cadets be issued a computer as well as a uniform and a simulacrum of a weapon and could raise cadet sights above winning drill competitions to computer-aided skill acquisition with each skill selected to be as pertinent for college preparation or civil job qualification as for a subsequent career in the Army. There might be strong Congressional support for a move in that direction and relevant courseware may lie readily at hand in the materials being developed by the Advanced Research Projects Agency for the Department of Defense School System (DODDS, the secondary schools maintained for military communities overseas. ARPA has underway a program for DODDS entitled "Computer Aided Education and Training Initiative," that aims at developing expert associates to guide individualized learning, collaborative applications for project-based educational resources, and smart navigators to access and integrate resources. TRADOC ought formally to join this effort, or to launch a parallel effort of its own.) Through computer-aided instruction, technical training for Military Occupation Specialties can be facilitated, accelerated, and evaluated as well. Moreover, during institutional training at entry, every soldier, whatever his or her specialty, could learn how to continue individual training after graduating from institutional training and taking up duties in a unit (regime II, Individual Training in Units) —prominent among the equipment they must know how to use will be that for accessing job aids and instructional materials direct from TRADOC. During the 1970's TRADOC attempted to improve regime II through its Soldier Manuals and through its Training Extension Courses (TEC). Instructional media then available for use in units —print and analog audio-visual tapes— constrained effectiveness. Force XXI, however, can be supported by real-time communications direct from the job-site to the appropriate TRADOC school and by interactive digital learning support materials delivered by means quite like the digital C4I devices the Army is now adopting. In fact, TRADOC ought to be able to conduct advanced skill training in units —or elsewhere for soldiers on the job— even more efficiently than is now the case in its traditional institutional settings.

Professional military education—leader development for cadets enrolled in the senior ROTC program and for noncommissioned officers and officers of the Active and Reserve components— ought to be reconfigured as predominantly non-resident, distributed instruction,

interspersed with short, temporary duty periods of institutional training at a site most favorable for the tasks being trained. Every effort should be expended to employ the methods and means of the information age to involve the student with course material, peers, and faculty even more than is possible in today's institutional training. Note that such a scheme will necessitate careful instructional system design, and painstaking evaluations to insure that learning is occurring. Again, close cooperation will be necessary between TRADOC's training developers and its combat developers so that courseware modernizes apace with unit materiel and Army doctrine. A final issue, affecting regimes III and IV, collective training in units, has been described above as the requirement for fully computational TES instrumentation, closely tied to provisions for IFF. Such materiel would be central to efficient collective training, whether at a CTC (regime III) or in a unit (regime IV).

Doctrine

"Doctrine" was originally understood by TRADOC to be implicit in both combat developments and training developments. TRADOC's starting premise was that doctrine is a common set of ideas on how to conduct sustained combat on land, consensus on what is taught in institutional training, and what is set as objectives for combat developments and training developments. Also, that TRADOC had to assure that same consensus obtained within the entire Army and among the United States Combatant Commands. In short, TRADOC perceived doctrine as an operational term.

In 1979 a separate organization was set up at TRADOC headquarters to manage doctrinal publications. A somewhat different view of doctrine crept in. After the several iterations of FM 100-5, and its dependent field manuals, it became accepted that doctrine equated to the written word. Adjectives like "draft," "approved," "published" came into use as a modifier for the noun, and verbs usually associated included "write," "articulate," "state." Doctrine became a "product," output measured in terms of the quality and quantity of publications — reasonable enough for a resource-strapped, school-house-centered TRADOC and in a very real sense, a historical throwback, but of doubtful relevance for Force XXI.

Throughout the 20th Century, as one symptom of chronic unpreparedness, the U.S. Army has typically confronted mobilization with a dearth of doctrinal publications, and sought then to remedies through one frenetic publishing scheme or another. When World War I broke upon the unready Army, there were no manuals available on trench warfare as practiced by the Allies on the Western Front. When the 1st Infantry Division was shipped to France in 1917, there was aboard the transport carrying then-Captain George C. Marshall only one dog-eared British booklet on the subject, passed from officer to officer among the division staff. Marshall records that the French and the British provided reams of paper on their organization and force structure, but very little on how to fight (Marshall, 1991). The American Army's dearth of publications in English on tactical doctrine is particularly striking in light of the fact that the British Army had been prolific with publications at the basic level on which the 1st Division sought guidance. (Griffith, 1994).

In 1939, with war clouds on the horizon in Europe, General Marshall, then Acting Chief of Staff, found that the faculty in Leavenworth had 152 field manuals in some stage of draft.

Marshall called the Commandant to order that these be published within 4 months, and when he was told "it can't be done," he gave the man one more chance, then fired him. Marshall sent Leslie J. McNair to take his place. McNair got the manuals out the door (Kahn, 1944). During World War II, McNair's Army Ground Forces produced doctrinal publications by the ton. Compared with the manuals of other countries, U.S. Army publications tended to focus on process rather than outcome, and to do so in great detail; manuals for close combat were particularly prescriptive (English, 1981). But in 1945, when the atomic bombs fell on Japan, grave doubts developed, understandably, over the continued pertinence of Army doctrine, and even over whether sustained warfare on land was any longer feasible. For this reason, and because of austere budgets, from 1946 to 1950 the Army neglected all aspects of DTLOMS. In 1950, when South Korea was invaded, a perception quickly developed that the circumstances of the conflict lay outside the framework of U.S. Army doctrine. Harsh reality soon reasserted itself; T.R. Fehrenbach (1963), in *This Kind of War*, points out that:

Americans in 1950 discovered something that since Hiroshima they had forgotten: you may fly over a land forever; you may bomb it, atomize it, pulverize it, and wipe it clean of life—but if you desire to defend it, protect it, and keep it for civilization, you must do this on the ground, the way the Roman legions did, by putting your young men into the mud.

The object of warfare is to dominate a portion of the earth, with its peoples, for causes either just or unjust. It is not to destroy the land and people . . .

The American soldier of 1950, though the same breed of man, was not half so good as the battalions that absorbed Rommel's bloody lessons, or stood like steel in the Ardennes . . . The problem is not that Americans are soft but that they simply will not face what war is all about until they have had their teeth kicked in. More than once, as at Valley Forge, after Bull Run, and Kasserine, the world has seen an American Army rise from its own ashes, reorient itself, grow hard and bitter, knowledgeable and disciplined and tough

In May 1952, of over 5,000 new trainees . . . slightly over half had Army General Classification test score of 80 or under —by Army standards unfit for training in any Army school. ... It seemed an unmistakable trend that only those too stupid to figure an out were coming into the ground forces.

Yet these men proved they could fight, and fight well, when trained.

If another war follows Korea, if American policy is threatened anywhere on the globe, it will not be years and months, as in two world wars, or days, as in Korea, but only hours until American troops are committed.

In battle, Americans learn fast—those who survive. The pity is, their society seems determined to make them wait until the shooting starts. The word should go out sooner, (pp. 427-439; 610-611)

In Korea, "rise from its own ashes" the Army did, led by Matt Ridgway and other leaders, but it had paid the historical price for battle learning. Regrettably, after the Korean War the Army and the other services lapsed into a doctrinal miasma over the questions of whether, and if so how, to maintain capability for both nuclear and non-nuclear war. This "dual-use" dilemma manifested itself mainly in decisions on divisional structure, for instance, the PEN-TOMIC Division (five battle groups) of the '50s, and the ROAD Division (Reorganization Objectives Army Division) of the early '60s (DePuy, 1994: 25-42). During its involvement in Vietnam, the Army allowed its doctrinal publications to atrophy, except as it needed new guidance on "counterinsurgency." In the early '70s, Army doctrine was in sad disarray. One critic of Army training noted that the Army's manuals could not be faulted for numbers or weight, but provided "irrelevant guidance (to trainers), out-of-date, incomplete doctrine, and little or no (training) technique." (Loory, 1973, pp. 124-126). There was no doctrine for combat in cities, fighting outnumbered or understrength, or even for the use of rifles. For example, FM 23-9 described the functioning and care of the Army's new rifle, the M-16. Marksmanship, however, was dealt with in FM 23-71, written nearly a decade earlier, when the issued rifle was the M-14; FM 23-71, moreover, presumed access to a TRAINFIRE range—a type range that was still, for most of the Army, an unfunded construction requirement. But neither FM 23-9 nor FM 23-71 dealt with engaging targets moving laterally with respect to the shooter, or fire distribution within a fire team, a squad, or a rifle platoon. One Army report of 1971 recommended reissuing the Leavenworth infantry manual of 1891 because it, at least, had a section on musketry.

Again, a revisiting of TRADOC's origins may be useful. TRADOC's first commander, pointing out that doctrine was consensus, instructed his subordinates that the proper place to evaluate the effectiveness of doctrine was out among the Army's divisions. In 1961 he had written a statement on doctrine the sense of which he repeated frequently from 1973-1977:

The interaction of doctrine, weapons, and organization leads to the development of tactics and techniques that are rehearsed and standardized through the process of training. Part of [organization and training] involves test and evaluation of tactics, weapons and organizations through field training exercises, which in time of peace are the closest thing to combat experience. The lessons learned through these exercises are then fed back into the doctrinal process, into the R&D programs, and emerge in the form of organizational modifications. Obviously, this cycling and recycling must be a closed circuit if it is to function properly. An entire field army, in a sense, is a vast, integrated weapon system. The interdependence of the working parts...is the ultimate expression of Army doctrine. (DePuy, 1994, pp. 37-38)

Publications may remain a necessary condition for doctrinal consensus, but even today, they cannot be considered sufficient. As the Army digitizes, paper-based communications are bound to become less appropriate than what is embedded in software. To promote and infuse consensus in Force XXI, TRADOC ought to exploit fully modern information technology, communicating with both components of the Army not only through manuals and pamphlets, but also through electronic publishing and archives, video tapes and direct video broadcast, interactive military simulation for maintenance and management, and tactical engagement simulation. The CTCs lend themselves readily to evaluating doctrine. TRADOC should be directed that doctrine must evolve continuously, and must govern both Training Developments

(methods and devices for training and for leader development) and Combat Developments (materiel requirements and their implications for organizations).

As far as doctrine's governing Force XXI, I recommend that the Chief of Staff of the Army promulgate guidance as follows:

Training Developments

- All operations shall be rehearsed in a Synthetic Theater of War
 - Under a Joint Task Force or Unified Command
 - By command groups, against high risk scenarios
 - By soldiers for teamwork on the objective terrain
- Army leaders, commissioned and non-commissioned officers, shall be networked with personal computers for dissemination of doctrine, for other distributed professional education, and for self-development.

Combat Developments

- Soldiers shall not fight for computers, but for each other; computers shall support dismounted and mounted teams alike.

Conclusion

To prepare for Force XXI, the Army must rejuvenate TRADOC, provide it mission and resources to develop tactical prowess using modernized tactical engagement simulation — live, virtual, and constructive. TRADOC must continue to develop leaders capable of functioning under battle stress. It must, as a matter of urgency, modernize all its individual training, judiciously applying distributed learning not only because it will be more efficient than 20th Century institutional methods, but also because it will be digitally relevant, mobilization particular, and doctrinally apt for the information age.

I want Force XXI to succeed. I leave to others prognostications concerning the height and English proficiency of its prospective soldiers. I trust that those who mastermind the Army's personnel classification will continue to improve their instruments. I am confident that, whatever the specific needs of Force XXI may be, the Army's recruiters and personnel managers will bring the requisite quality soldiers into service. What worries me is that the Army of today and tomorrow may not have the wherewithal properly to prepare for them, to train them imaginatively, and hence, to make their service rewarding. I believe that the Army will attract to and retain in Force XXI, young Americans of quality only to the degree that the Army conveys to those youngsters and to their parents a sense of purposeful service, trains soldiers hard and well to win battles, and develops competent and confident leaders for flexible, well-manned, powerfully-equipped, superbly-prepared fighting divisions. Therefore, I hold that the Army 2010 Conference should advise the Chief of Staff of the Army to recharge TRADOC, a proven means to those ends.

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