

PHYSICAL TRAINING PROGRAMS IN LIGHT INFANTRY UNITS:
ARE THEY PREPARING SOLDIERS FOR
THE RIGORS OF COMBAT?

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

PHYSICAL TRAINING PROGRAMS IN LIGHT INFANTRY UNITS: ARE THEY PREPARING SOLDIERS FOR THE RIGORS OF COMBAT? By Major Frederick M. O'Donnell, USA, 114 pages.

This thesis studies whether light infantry physical training (PT) programs include the combat focus necessary to prepare soldiers for the rigors of combat. United States Army physical training doctrine stresses the development of PT programs that enhance military skills essential to effective combat and duty performance. Programs must integrate the interactive components of strength, mobility, and endurance.

Unit mission essential task lists (METLs) provide a finite number of wartime tasks. Examination of light infantry METLs, plus identification of supporting platoon and individual tasks, revealed the physically demanding tasks an infantryman performs on the battlefield. These were then analyzed to determine the demand required regarding the physical readiness components.

Surveys determined the frequency and types of tasks executed during unit physical training PT. Those tasks executed most routinely in units were analyzed to determine their physical readiness component demands. This facilitated comparison between light infantry combat tasks and tasks present in unit PT programs.

Results indicate that although strength and endurance are integral parts of light infantry PT programs, mobility is almost nonexistent. This critical component is the functional application of strength and endurance. Its omission from unit programs is a glaring weakness in preparing soldiers for the fluid and complex combat environment.

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This thesis hinged on identifying what units in the light infantry community were doing for physical training and the completion of hundreds of surveys was essential in making that determination. Special thanks go to the infantryman in the Command and General Staff College Class of 2001 and infantrymen in Combined Arms Service Staff School Classes 01-2 and 01-3 for their timely and candid feedback to the surveys. I am especially indebted to those officers and non-commissioned officers “in the field” who did the real leg work in distribution and collection of large numbers of surveys-- Lieutenant Colonels Ricky Gibbs and David McBride, Command Sergeant Major Earl Rice, Staff Sergeant Robert Jones, Captains Joe Ryan, Greg Anderson, John Cogbill, Shawn Daniel, Chaz Bowser, Arie Richards, Mac Tonsmeire, and Majors Joe Hartman, and Mike Pemrick. Without their help and assistance, the real “meat” of this thesis never would have been available to analyze.

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ABBREVIATIONS

| | |
|--------|--------------------------------------|
| APFT | Army Physical Fitness Test |
| APRT | Army Physical Readiness Test |
| AR | Army Regulation |
| ARI | Army Research Institute |
| ARTEP | Army Training and Evaluation Program |
| CAS3 | Combined Arms Service Staff School |
| CGSC | Command and General Staff College |
| FM | Field Manual |
| FTX | Field Training Exercise |
| IMT | Individual Movement Techniques |
| LCE | Load Carrying Equipment |
| METL | Mission Essential Task List |
| MMAS | Master of Military Art and Science |
| MOS | Military Occupational Specialty |
| MOUT | Military Operations in Urban Terrain |
| MTP | Mission Training Plan |
| NCO | Noncommissioned Officer |
| NEO | Noncombatant Evacuation Operations |
| PT | Physical Training |
| SAMS | School of Advanced Military Studies |
| SMCT | Soldiers Manual of Common Tasks |
| TRADOC | Training and Doctrine Command |

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CHAPTER 1

INTRODUCTION

The United States Army physical fitness doctrine tells leaders, “If we fail to prepare our soldiers for their physically demanding wartime tasks, we are guilty of paying lip service to the principle of ‘Train as you Fight.’”¹ Train as you fight has been one of the Army’s fundamental training principles for many years. Though routinely and successfully applied while training on critical wartime tasks, this principle is to a much lesser degree successfully integrated in its application to the Army’s physical fitness programs.

The light infantrymen’s level of physical fitness has a direct impact on their ability to accomplish the mission. Those light infantry soldiers who arrive at the battlefield unprepared for the physical demands of the environment will ultimately fail. Train as you fight, when applied to critical wartime tasks, means routinely subjecting soldiers to situations similar to those they should expect in combat. From a physical fitness perspective, this means replicating physical movements that will be required in combat and strengthening muscle groups to support these movements. Ultimately, by adequately preparing light infantry soldiers for the physical demands expected in combat, leaders ensure that when contact is made with the enemy, soldiers possess a reserve of stamina and strength that leads to defeat of the enemy.

Within any Army organization, leaders are charged with developing physical readiness in their soldiers. Physical readiness requirements, however, are not the same for all soldiers. Requirements vary significantly by military occupation specialty (MOS)

and more specifically by the mission essential task list (METL) a unit is expected to perform. Leaders who recognize this and can successfully derive relevant physical training tasks from proposed METL will succeed in adequately preparing for the rigors that should be expected in combat.

History

Throughout history, infantrymen have been expected to successfully complete missions under the most arduous of circumstances. Though technology and tactics have varied, the physical demands placed on light infantry soldiers have remained constant. Numerous historical examples support this. In 1805 during the Battle of Austerlitz, Napoleon moved a corps 80 miles in 50 hours and had them enter battle directly off the march. During the Civil War, Major General U. S. Grant marched union troops 40 miles in 27 hours to position them for the final siege of Vicksburg. In 1965, the 1st Cavalry Division engaged the North Vietnamese at Landing Zone X-Ray in the rugged Central Highlands of South Vietnam in what has been described as some of the most fierce fighting in the Vietnam War. An account of the fighting gives insight into the great physical demands placed on the soldiers.

We were advancing toward the enemy when two of my men and one from another squad were hit by machine-gun fire. . . . I crawled to aid the wounded. I was able to drag two of the wounded back to our defensive line. . . . As I attempted to drag a third back, I was wounded.

All this time I had been jumping, dodging, hitting the dirt, and moving forward with Adams (assistant gunner). . . . I was feeding belt after belt of 7.62 mm ammunition into the gun. We were prone and he was firing at the enemy in front and to the right.²

In July 1993, 2-14 Infantry (10th Mountain Division) left the mild summer climate of Fort Drum, New York, for the overwhelming oppressive heat and humidity of

Mogadishu, Somalia, to serve as the Quick Reaction Force (QRF) for the United Nations command in Somalia. On 3 October, responding to a QRF alert, the battalion fought its way over a 17-hour period from the Mogadishu airfield to downtown and extracted ground elements of Task Force Ranger. In the fighting, 2-14 Infantry sustained casualties to include two killed in action (KIA) and 24 wounded in action (WIA). In the successful execution of this mission, these light infantry soldiers battled the heat while wearing flack vests, maneuvered great distances over urban terrain, and treated and evacuated casualties, all while under a continuous hail of fire.

As these historical examples illustrate, combat conditions can be overwhelming. Soldiers who see conditions to this extreme for the first time in combat are doomed to failure. In S. L. A. Marshall's book *The Soldier's Load and the Mobility of a Nation* Marshall refers to the need for "schooling the soldier until he believes that a toughened back and strong legs will give him his main chance for survival."³ Lieutenant Colonel William David, the commander of 2-14 Infantry, applied a similar philosophy in the development of physical readiness in his soldiers. Though he believed in a combat-focused approach to physical training, he built mental and physical toughness through a demanding road march program that culminated in quarterly 25-mile road marches with combat equipment. This program continued after the unit deployed into Somalia. It was this mental and physical toughness, built through his road march program, with which Lieutenant Colonel David credited the success of the mission.

Like Lieutenant Colonel David, leaders who recognize the physical challenges inherent in combat and take steps to specifically prepare their soldiers usually meet with success. In 1943, while the 3rd Infantry Division was deployed in Algeria awaiting

Operation Huskey, Major General Lucian Truscott implemented a physical training program that included log rolling, bayonet training, hand-to-hand fighting, rope climbing, and road marches to exacting standards. This pre-invasion training paid off in Italy where in five days, after fierce fighting in Agrigento, the 3rd Infantry marched 100 miles to Palermo.⁴ Despite brutal fighting, Truscott's troops were heard to say "fighting the battle was a damn sight easier than training for it."⁵

Lieutenant Colonel James Rudder and his 2nd Ranger Battalion represent another great example where an ability to anticipate the demands of the battlefield and develop a plan to overcome them led to success. Formed for the upcoming Normandy invasion in April 1943, the 2nd Ranger Battalion was given the mission to destroy the German gun emplacements on the top of Point du Hoc--a 120-foot cliff that virtually rose from the edge of the water. In anticipation of this mission, Lieutenant Colonel Rudder integrated speed marches, hand-to-hand combat, obstacles courses, and repetitive and challenging climbing exercises to help build the upper body strength necessary for successful completion of the mission.⁶ While preparing for the Normandy mission at Bude in Western England, Rudder made rope climbing the basic staple of his physical fitness and training programs. Prior to their departure, Rangers were proficient at scaling cliffs of 100 feet with all their combat equipment under varied conditions. Rudder's techniques also included the integration into physical training of tackling dummies, conducting obstacle courses under live fires and demolitions, and competing in man-on-man physical contact. Fifty-five years later, the Rangers successful and heroic accomplishment of this D-Day mission remains one of the greatest accomplishments in modern military history.

Unfortunately, the U.S. Army has not always successfully prepared its soldiers for combat. In 1950, just a scant five years after World War II and the valuable lessons learned concerning combat physical readiness, the United States deployed forces to Korea that were wholly unprepared for the challenges in the environment or on the battlefield. As the reports came back, an alarming number of casualties were attributed to the inability of U.S. soldiers to physically withstand the rigors of combat over rugged terrain and under unfavorable climatic conditions.⁷

Modern Light Infantrymen

Light Infantry soldiers today, despite a lack of combat experience, do not necessarily need these historical examples to understand the importance of a demanding physical training program. They have conducted extended dismounted operations at the Joint Readiness and National Training Centers (JRTC and NTC), numerous grueling road marches, and countless demanding live fires and field training exercises. They have probably also learned that even relatively basic infantry tasks, when conducted under arduous conditions, are much more difficult to master. Marksmanship is a prime example. On a marksmanship range, with no outside distractions, most experienced infantryman can shoot expert without much difficulty. However, if put on the same range, but with an increased heart rate and carrying the mission essential equipment a soldier takes into combat, the very fundamentals take on a whole new challenge. Results invariably are far worse. The lesson is very clear for infantry leaders--combat physical readiness and successful mission accomplishment are inextricably linked. Leaders must anticipate the demands soldiers will encounter in combat and develop programs that help

offset degradation in performance. In many ways, this means abandoning many of the notions young leaders have concerning physical training (PT).

In light infantry units today, there are numerous hurdles to overcome in the development of any good physical training program. The first, and most noticeable, is an embarrassing lack of doctrine that addresses developing a combat focused physical readiness program. Young leaders do not have a doctrinal reference that adequately teaches tailoring a unit physical training plan to the tasks and missions a unit is expected to conduct in combat. The Army's physical fitness bible--FM 21-20, *Physical Fitness Training*--is a good manual that emphasizes combat readiness and train as you fight but does an equally poor job of explaining how to do this. Lieutenant Colonel Bill Reiger, the Commandant of the Physical Fitness School and the proponent for FM 21-20, admitted so much in an interview in which he said, "Current doctrine does not coordinate with what soldiers have to do in the field."⁸ Lieutenant Colonel Reiger continued by saying that the Army physical fitness test (APFT) does not adequately correspond to the actual physical readiness of a soldier in the performance of his combat tasks. This void has placed an ever-increasing onus on company-level leaders and the role they play in developing physical readiness programs.

Physical training must be leader supervised, and an interest and desire must exist within the leadership to develop an effective program. Leaders that are not physically fit are less likely to push themselves, or their units, during physical fitness training.

Like any other form of training, physical fitness training, and especially combat-focused physical training, requires planning and resourcing. To achieve the desired end states, leaders must carefully assess weaknesses, then deliberately target those

weaknesses with a program designed to improve performance over time. This strategy cannot be successful when the PT session is planned minutes before the morning PT formation. In programs where this happens, soldiers are usually subjected to a daily regimen of push-ups, sit-ups, and a moderate run. Over time, it leads to lack of interest and apathy. One of largest values of adding combat focus to a physical-training program is simply the creativity that can result. This alone can do wonders for a program.

Often, the responsibility for the conduct of PT is pushed to lower and lower levels within the chain of command. In many light infantry units, PT is conducted at the squad level. Squad leaders have the educational base to build effective PT programs. With high operational tempo (OPTEMPO), and the competing demands against leaders, often team leaders (TLs) find themselves leading PT. They generally lack the experience, education, or maturity to effectively plan or execute a challenging physical fitness program.

Lastly, the overriding importance placed on the APFT has had an overwhelming impact on the light infantrymen's physical training programs. Only a few basic and isolated components of physical fitness--the push-up, sit-up and two-mile run--have become the center of gravity in many Army physical fitness programs. This has happened, in part, because the APFT is the only universally accepted measure of physical fitness. It allows promotion boards, Department of the Army schools, and commanders to make comparisons and assessments across MOS lines. Additionally, in an effort to show command emphasis on unit physical fitness, units often create incentive programs that tie rewards with the results achieved on the APFT. These have taken the form of "streamers" at company level, passes for superior individual performance, and even the

awarding of a badge for the physical fitness uniform for those that score above a certain mark. For many reasons, Army leaders must accept that the APFT is important and will continue to be used as a baseline measure of physical fitness. What light infantry leaders must understand, however, is that the development of a combat-focused PT plan will address the APFT and more effectively prepare their soldiers for combat.

A recent Center for Army Lessons Learned article published a strategy for conducting battle-focused physical training in preparation for a Combat Training Center rotation. In this article, it says that the program should be initiated three to six weeks prior to deployment. It is thinking such as this that is totally flawed. Units should always be focused toward battle-focused physical training. Though given ample time and train-up for a combat training center rotation, units do not always have the luxury of early warning for deployment into combat. Light infantry units must constantly be preparing for that eventuality.

The Science of Combat Physical Readiness

Combat-focused physical training programs build combat physical readiness. In general terms, being combat physically ready means enduring hardship, withstanding stress, and executing tasks under difficult and demanding situations. In other words, it has a physical and mental component. What makes the infantrymen's challenge so unique is that, not only must they overcome the physical duress of getting to the fight, they must have a reserve of strength and stamina upon arrival to impart instruction, make sound decisions, perform technical skills (marksmanship, call for fire, etc.), and successfully complete the mission. Fear and fatigue play a debilitating role in the accomplishment of this mission and it is their effects that must be minimized.

Understanding the causes and effects of fatigue and fear are central to overcoming them and optimizing performance on the battlefield. Most physiological research traces fatigue to three general areas--the neuromuscular junction, the contractile mechanism of the muscle, and the central nervous system.⁹

Of these three factors, failure at the neuromuscular junction is widely viewed as the greatest contributor to fatigue. This theory concludes that the depletion of a chemical transmitter, acetylcholine, at the neuromuscular junction causes the muscles to weaken and eventually fail. Intense physical training, however, produces increased levels of acetylcholine as a transmitter for the muscles being used. Conversely, this increase in acetylcholine inhibits the production of other chemical transmitters that normally hinder the production and transfer of acetylcholine within each neuromuscular junction. Consequently, repetitious training of certain muscles and muscle groups will lead to the increased production and efficient transfer of acetylcholine and the postponement of fatigue during combat.

Failure at the contractile mechanism results from a lack of oxygen and blood flow caused by the inefficiency of the heart and lungs. If glycogen stores have been depleted in the muscles (caused by a lack of training in short-burst activities) or if the muscles do not produce adequate levels of adenosine tri-phosphate (ATP) and phosphocreatine (PC) needed for activities requiring stamina, then fatigue occurs.¹⁰ The teaching point is that physical training must occur across the entire spectrum of energy systems involved. An over reliance on either short-burst activities or long-distance running has an equally debilitating effect on the contractile mechanism. A balance must be achieved.

The last major fatigue-inducing factor is the central nervous system. Physiologists have determined through numerous experiments in “diversion mentality” that by shifting the mind from the activity being performed, through imagery techniques or progressive relaxation, the onset of fatigue will be delayed.¹¹ Essentially, they postulated this delay could be achieved through the application of certain mental exercises.

Though understanding fatigue is critical, fear has an equally important role in affecting performance. Many are familiar with the physiological effects of fear-- increased heart rate, increased blood sugar levels, increased “brain firing,” and increased muscular tension. These symptoms occur as a result of the dumping of a hormone that contains both cortisol (a steroid) and adrenaline (an amino acid) after the body has sensed fear or been placed in a suddenly stressful situation. Though adrenaline is often beneficial and can increase performance over a short period of time, the cortisol remains in the body longer and therefore, has an effect over a much longer period of time. The effect is the maintenance of an increased heart rate and increased muscular and mental tension that fatigues the body. Unfortunately, both physically fit and nonphysically fit people have the same reaction to fear, and thus, it has been widely held that cortisol secretion cannot be controlled through physical training.¹² Psychologists have found, however, that by teaching the mind to relax in stressful situations, cortisol secretion can be decreased. This can be achieved in two ways as related to combat-focused physical training: (1) by placing soldiers in demanding and stressful situations (train as you fight mentality) so that when placed in combat the stimuli is less stressful and (2) by

employing the relaxation technique mentioned above during those situations in which a soldier has never been introduced.

Proper physical training can adequately prepare soldiers for the fatigue experienced in combat, but the effects are specific to the types of training performed and the type of program implemented. The body adapts only to those stresses placed upon it. In order to be most effective, physical training must be specific to those tasks that the soldier is expected to perform in combat.¹³ Leaders must realize that intense specific exercises will go much further in preparing soldiers for combat than the maintenance of a physical fitness program.

Problem Statement

History has shown that light infantry soldiers in combat are often asked to move long distances, carrying heavy loads, with little rest, and are expected to fight and win on arrival to the battlefield. To accomplish this, these soldiers must exhibit a mental and physical toughness honed during rigorous and demanding peacetime training events. The necessity in building mental and physical toughness, and thus combat readiness, is as important today as it was 200 years ago.

When a soldier arrives at the objective area or is in contact with the enemy, success depends on his ability to think clearly, accurately assess the situation, react calmly, and overcome the physical challenges and stresses presented. In combat, many factors affect an individual's performance and decision-making abilities. These factors include inexperience, stress, fear, and fatigue. In 1947, drawing on lessons from World War II, General George S. Patton remarked that: "Fatigue makes cowards of us all."¹⁴

This is essentially the light infantryman's challenge--to overcome the fatigue that dilutes physical and mental effectiveness on the battlefield.

Having now underscored the importance of combat physical readiness, this thesis attempts to determine whether light infantry PT programs include the combat focus necessary to prepare soldiers for the physical demands of combat.

Definitions

The following definitions are essential to this study:

Aerobic Endurance: The efficiency with which the body delivers oxygen and nutrients needed for muscular activity and transports waste products from the cells. Aerobic exercises include long distance running, biking, and foot marching.

Anaerobic Endurance: The ability to extend anaerobic effort or the body's anaerobic threshold. The anaerobic threshold is generally regarded as the point when blood lactate starts to rise sharply, indicating that aerobic pathways are no longer adequate to sustain the activity.¹⁵ Anaerobic activities include sprinting, soccer, and basketball.

Combat-Focused Physical Training: Physical fitness training that enhances soldiers' ability to complete critical soldier or leader tasks that support the unit's METL.

Combat Physical Readiness: The ability to endure physical hardship, withstand stress and carry on under difficult and demanding situations. It also includes the ability to perform arduous, complex, and often explosive physical tasks not demanded during peacetime.

Flexibility: The ability to move the joints (for example, elbow, knee) or any group of joints through an entire, normal range of motion. Flexibility is essential in performing movements safely.

Functional Fitness: Includes agility, balance, coordination, and numerous other physical parameters that translate into METL capabilities.

Light Infantry: Defined by the rifle platoon and rifle company. An organization that is prepared to fight on any terrain and whose mission it is to close with the enemy by fire and maneuver in order to destroy or capture him, or to repel his attack by fire, close combat, or counterattack. All airborne, air assault, and conventional light infantry forces will fall under this heading.

Muscular Endurance: The ability of a muscle or group of muscles to perform repeated movements with a submaximal force for extended periods of time.

Muscular Strength: The greatest amount of force a muscle or group of muscles can exert in a single effort.

Speed: Rate of movement. Speed is improved through perfection of technique and conditioning.

Stress: To subject to pressure or strain. Can impede physical and mental processes and performance.

Assumptions

There are a number of underlying propositions that are understood to be true in the acceptance of this thesis. First, the terms “combat-focused physical training” and “physical readiness training” are synonymous. These terms are used loosely in many of the references reviewed thus far. Within this thesis, physical readiness training has been

defined to mean training on physical tasks a light infantryman would expect in combat. Combat-focused physical training means incorporating combat-like representative tasks into a physical fitness training program. They are essentially saying the same thing.

Secondly, Army Physical Fitness School (APFS) input and information can be considered fact. As the Army's proponent for physical fitness, their charter and responsibilities give them the broad visibility to make accurate assumptions on the state of physical fitness in the U.S. Army.

Lastly, fundamental to this thesis is the notion that a representative exercise can help improve a combat critical individual task because it works the same muscle groups or similar physical readiness components. For instance, a program that incorporates pull-ups as a representative exercise could improve a soldier's ability to climb a rope because they work the same muscle groups, and share an equal demand for similar physical readiness components, although they are not the exact same task.

Limitations

There are several limitations that impose on this study. Most importantly, there is not a "tool" or accepted norm currently available to measure combat physical readiness. Though a combat-focused physical training program can certainly improve physical readiness, there is not currently in existence a means to evaluate this and provide meaningful feedback. Though it is possible to build a model, determine appropriate physical training events, and from that measure and assess performance, a meaningful standard for overall mental or physical toughness can only be developed by studying results over time and from that, determining appropriate standards. Generally, commanders make such assessments through unit performance during physically

demanding training events. Combat-focused physical training is a means to the end of establishing a combat physically ready unit.

Another limitation will be the resources available. With the narrow focus established for this thesis, many resources have purposely been excluded. This can be overcome by close work with the APFS and other subject matter experts who will direct efforts to those resources that will have the greatest value. This may be books, articles, or current literature being provided by the APFS.

Delimitations

This thesis is designed to determine whether light infantry physical training programs are preparing their soldiers for the physical demands of combat. As a result, this thesis discriminates by MOS and branch of Army and by nationality. Many groups are intentionally excluded from the research. The scope of the research is restricted to light infantry units in the U.S. Army. This would exclude other light infantry units in the U.S. armed forces (i.e., Marines) and light infantry units in foreign armies. This focus is not meant to exclude U.S. Army National Guard (ARNG) units that represent a large percentage of today's combat forces. ARNG light infantry units will be asked to perform the same physically demanding tasks as active duty light infantry units if called to battle. The requirements should be the same. However, because this thesis seeks to determine whether or not light infantry physical training programs are preparing soldiers for the rigors of combat, the infrequency with which ARNG meet and are able to perform physical training inhibits an effective analysis. Though the physical requirements are the same, the responsibility for physical fitness is largely the responsibility of the individual

soldier. This thesis focuses on unit preparation for the physical demands likely to be experienced in combat.

Additionally, this thesis will not explore what may be similar programs in mechanized infantry units or other combat arms. As mentioned earlier, the light infantry mission and combat physical readiness go hand in hand. Very few MOSs or branches require the high level of physical fitness demanded of the light infantryman to be successful on the battlefield.

This thesis will also more narrowly define the time period for light infantry programs and physical training doctrine researched. Specifically, models or physical training programs that were institutionalized prior to the twentieth century will not be examined. Essentially, from a research perspective, this means restricting the focus from World War I to the present.

Significance

Combat physical readiness is essential to the success of the light infantry soldier on the modern battlefield. Light infantry units today are led by bright and competent leaders who understand the importance of physical readiness to overall mission accomplish. At times, it is easy to forget that combat physical readiness means more than running fast or executing 100 push-ups or sit-ups. It is a science. It means being able to look at a list of tasks soldiers are expected to execute in combat and arrive at representative tasks that replicate the physical movements or strengthen similar muscle groups which support those movements. Too often, leaders marvel at the soldier who can run two miles in under 11 minutes and are confused when that same individual cannot successfully complete a 12-mile roadmarch with combat equipment. This happens when

leaders do not understand physical readiness training and should give cause to reflect on where efforts in a light infantry battalion should be directed.

Understanding these concepts is important to all leaders--whether light infantrymen or truck drivers. Though this thesis is light infantry specific, those who understand the concept and can apply it to their particular branch or functional area will make significant strides in better preparing their soldiers for combat.

¹Department of the Army, FM 21-20, *Physical Fitness Training* (Washington, DC: Department of the Army, 30 September 1992), iii (hereafter cited as FM 21-20).

²Lt. Gen. Harold G. Moore and Joseph L. Galloway, *We Were Soldiers Once...and Young* (New York, NY: Random House, 1992), 95.

³S. L. A. Marshall, *The Soldiers Load and the Mobility of a Nation* (Quantico, Virginia: Marine Corps Association, 1950), 52.

⁴Major Mark P. Hertling, "Physical Training for the Modern Battlefield: Are We Tough Enough?" (School of Advanced Military Studies Monograph, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1987), 14.

⁵Roger Spiller, ed., *Combined Arms in Battle Since 1939* (Ft. Leavenworth, Kansas: U.S. Army Command and Staff College Press, 1992), 281.

⁶Major Michael D. Pemrick, "Physical Fitness and the 75th Ranger Regiment: The Components of Physical Fitness and the Ranger Mission" (Master of Military Art and Science Thesis, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1999), 6.

⁷FM 21-20, (30 September 1992), iii.

⁸Jane McHuch, "PT Overhaul," *Army Times*, 28 August 2000, 14.

⁹Hertling, 4.

¹⁰Ibid., 5.

¹¹Ibid., 7.

¹²Ibid.

¹³Ibid., 8.

¹⁵Major Danny McMillian, Dr., e-mail correspondence with the author, Fort Leavenworth, KS, 22 March 2001.

CHAPTER 2

LITERATURE REVIEW

Introduction

This thesis attempts to determine whether or not the physical fitness training being conducted in light infantry battalions includes the combat focus necessary to prepare light infantry soldiers for the rigors of combat. Primarily, this literature review focuses on the physical fitness doctrine that leaders are referencing in the building of physical training programs, unpublished works that have delved into this and similar topics, and lastly, literature that helps define the physical and mental demands of combat from a light infantry perspective.

U.S. Army Physical Fitness Doctrine

Army Regulation 350-41, *Training in Units*, is the Army regulation that governs and directs U.S. Army physical fitness training policies and procedures. This regulation establishes the basic guidelines that apply Army-wide. It includes all branches, all units, and all operating agencies.

As an Army regulation, and thus applicable to all units and branches, it provides very general and broad guidelines. The regulation states that the objective of the Army Physical Fitness Program is to enhance combat physical readiness by developing and sustaining a high level of physical fitness in soldiers. It requires that soldiers conduct the Army physical fitness test (APFT) at least twice annually, but quickly qualifies the purpose of the testing. The regulation states that “physical fitness testing will not form the foundation of unit or individual fitness programs; it is simply one element of a total

program. Fitness testing is designed to ensure the maintenance of a base level of physical fitness essential for every soldier in the Army, regardless of MOS or duty assignment. Unit programs must be designed to take this base level of conditioning and raise it to help meet or exceed mission-related physical performance tasks” (AR 350-41).

The regulation further states that “as a first priority, commanders will conduct physical fitness programs that enhance soldiers ability to complete critical soldier or leader tasks that support the METL. Preparation for the APFT is of secondary importance.” Lastly, and most importantly, it urges commanders to “make every effort to design and tailor programs according to what their soldiers may be expected to do in combat.”¹

These statements and guidelines are very important to this thesis. Though a regulation, this directive gives great flexibility to all commanders and mandates a minimal number of formal requirements. The major requirement that it does direct, the APFT, has become so routine that it is part of Army culture. Though it does not necessarily measure a soldier’s combat readiness, it does provide feedback on a soldier’s physical fitness and is a tool the commander can use to help assess his physical training program. Very few object to the requirement of the APFT.

More importantly, this regulation recognizes that commanders must develop physical fitness programs that enhance the soldier’s ability to complete critical tasks that support the METL and that preparation for the APFT is of secondary importance. Without denigrating the importance of the APFT, it reminds leaders that their goal is to prepare soldiers for the demands they should expect on the battlefield. Therefore, the

implied task for leaders is to build programs that prepare soldiers for the demands of combat and to build appropriate evaluations that assess this readiness.

Overall, this regulation gives superb guidance without being unnecessarily burdensome with requirements. As a result, it provides the flexibility that major subordinate commands need to further develop their mission specific programs.

Field Manual (FM) 21- 20, *Physical Fitness Training*, serves as the Army's doctrine when it comes to physical fitness training. Like the regulation, the FM is quick to remind leaders that the purpose behind a physical fitness program is to prepare soldiers for their physically demanding wartime tasks. Not only does it address this issue in the preface, but it begins with an example of the disastrous results when U.S. troops are employed in combat who are not physically prepared for their wartime tasks or the environment in which they must fight.

As a guide in developing overall physical fitness, this manual is superb. It discusses in detail the components of physical fitness and identifies them as muscular strength, muscular endurance, cardiorespiratory endurance, flexibility, and body composition. It explains that the first three of these components (muscular strength and endurance and cardiorespiratory endurance) have an impact on body composition and will result in less fat. This is important because excessive fat detracts from the other fitness components, reduces performance, and negatively affects one's health. Additional fitness factors, such as speed, agility, muscle power, eye-hand coordination, and eye-foot coordination, are classified as components of "motor" fitness. Though FM 21-20 draws a distinction between these groups, it states that the Army's fitness program seeks to improve or maintain all the components of physical and motor fitness. The manual

devotes significant effort to explain how to train for each of these activities and provides exercises and events that sufficiently develop these components.

The manual devotes an entire chapter, Chapter 10, to developing the unit program. It advises leaders to use the following seven step process: (1) analyze the mission; (2) develop Fitness Objectives; (3) assess the unit; (4) determine training requirements; (5) design fitness tasks; (6) develop a training schedule; and finally, (7) conduct and evaluate training.

As a process, this is an accurate and valid approach to building a unit physical fitness program. The problem, however, is that it lacks the specificity and detail to be of any use to young leaders. The manual's examples are so broad that they provide little value to the reader. At company level, noncommissioned officers (NCOs) and junior officers who actually build these physical readiness programs do not have a sports physiologist with which they can readily consult nor has the infantry branch taken the additional time to augment this with infantry-specific examples. As a result, "hard" physical training is defined in most units as achieving muscle burn-out on sit-ups or push-ups, and running long distances or fast, short distances--not the intent or the intended consequence of the guidance that is given in FM 21-20.

Though most leaders can examine a unit METL and from that identify the most demanding individual tasks, the problems lie with assessment (step 2), determining training requirements (step 3), and designing fitness tasks (step 4). All infantry units use basically the same physical tasks to make assessments on soldier fitness. These include the APFT, the 12-mile road march, and the standard 5-mile run. These assessments are valuable and valid because there is ample statistical data to support them. They have

been tested over time. The problem is amplified in the following example. A leader makes an assessment that the unit lacks upper body muscular strength--an assessment made when few of his soldiers can successfully climb a rope. Though he may recognize this as a weakness, there is nothing that defines his requirements. If he integrates a strength-conditioning program to attack this weakness and includes lateral pull-downs (a pulling exercise that works the same muscles), there is no standard that tells him how much his soldiers should be able to pull or what, if pulling a standard weight, their range of scores tells him. Additionally, there is nothing that lists a set of tasks or exercises, which work specific muscle groups. Assessments that involve the APFT, 5-mile run, and road march are easy because published scales exist that enable assessments to be made rather easily. Once outside of these core events, implementation of the seven step process becomes much less clear.

Even more confusing for the infantryman is determining an assessment that evaluates a soldier's combat physical readiness as it applies to the unit METL. Once again, determining the specific tasks to be evaluated and interpreting the data are very difficult tasks. That difficulty is evidenced by the fact that the infantry does not have a standard separate assessment for its soldiers. Both the Army regulation and Field Manual say that the APFT is not a measure of combat physical readiness, yet the infantry community has not determined standard assessments by which its various MOSs (11B, 11C, 11H, and 11M) can be evaluated. If it is determined that units do not include the necessary combat focus to prepare their soldiers for the rigors of combat (which this thesis seeks to determine), then this void in physical training doctrine could easily be the cause.

FM 21-20 has served as the Army's physical fitness doctrine since the 1940s. It has been revised on numerous occasions and in some areas, especially in its discussion of the components of physical fitness, has progressed greatly over the past 60 years. In other areas, especially its assistance in helping units build combat physical readiness, it has actually regressed. The 1957 version of FM 21-20 incorporated feedback from the Korean War in which leaders reported appalling levels of physical condition. This weakness is cited as a reason that a less-equipped North Korean Army was able to route U.S. forces. In this version of the manual, two tests are recommended--a physical fitness test to determine a soldier's general fitness and a physical achievement test to determine a soldier's ability to perform basic battlefield tasks. The physical achievement test included a seventy-five yard dash, five-second rope climb, triple broad jump, 150-yard man carry, and one-mile run. This test was later amended to be comprised of a forty-yard low crawl; horizontal ladder; dodge, run, and jump; grenade throw; and the one-mile run. Each of these tests does a far better job of assessing combat critical skills than the current APFT. Today, a unit's combat physical readiness has become a rather subjective assessment on the part of the commander. Though these combat-focused assessments above may not have provided the only assessment of combat readiness for the commander, it certainly helped identify important trends.

Two other doctrinal references exist, but are of little value or assistance to leaders and soldiers today. They are Department of the Army Pamphlet (DA PAM) 350-15, *The Commander's Handbook on Physical Fitness*, and DA PAM 350-18, *The Individual's Handbook on Physical Fitness*. Both of the manuals were commissioned in the early 1980s following an inquiry in 1980 by President Jimmy Carter into the level of physical

fitness in the armed forces. Neither have been updated since their initial publication dates. Though these manuals addressed concerns at the time, they became outdated with the 1986 version of FM 21-20. This version introduced the APFT as a measure of fitness (not readiness) and included the test as soldiers know it today. These DA PAMs are not referenced today and do include useful information that is not already available in FM 21-20.

Doctrinally, today's soldier has one reference to consult in building physical fitness and readiness in units and individuals, FM 21-20. FM 21-20 was last published in 1992. Over the last eight years, numerous interesting and informative articles, studies, and theses have filled the void created by the lack of evolving doctrine. Though they have not made their way into current manuals, they are important to the conduct of this study because they examine trends, observations, and feedback with which doctrine has yet to catch up.

Unpublished Sources

A 1987 School of Advanced Military Studies (SAMS) monograph entitled "Physical Training for the Modern Battlefield: Are We Tough Enough?" by Major Mark Hertling concludes that changes must be made in the army's physical training programs if the goal is to meet the challenges posed by Airland Battle Doctrine and divisional contingency missions. He concluded that overemphasis on the APFT had polluted the combat focus needed in physical training. Three of his prominent conclusions were that the Army needs to de-emphasize the APFT, build physical readiness programs around probable contingency deployments, and emphasize physical training "readiness" versus "fitness."

In arriving at these conclusions, Major Hertling analyzes some of the physiological and psychological demands of combat. Additionally, he compares the U.S. Army's physical training programs with those of cold war nemesis, the Soviet Union. His analysis concludes, interestingly enough, that the Soviet's physical training programs were far superior to those implemented in the U.S. Army. In part, this was the result of a regional board outside of unit chains of command that were active in assisting units with their physical training programs.² These boards worked hand in hand with commanders, who had overall responsibility for their respective unit programs. The Soviets, however, were also creative in their assessment of physical readiness and emphasized specialized exercises that were geared toward combat specialties.³ Soldiers were directed to participate in at least five official Olympic-event sports competitions or military contests annually and complete a pentathlon (pull-ups, 100 meter dash, 3 kilometer cross-country run, 100 meter swim, and 10 kilometer ski race) twice annually. Additionally, each particular service or branch executed a branch specific biathlon twice each year. As an example, one part of the paratroop biathlon required the soldier to stand in a 10-meter tower in full combat dress with submachine gun and parachute mock-up. As the course began, he slid down a cable line, opened his grenade pouch, and threw three grenades at targets along the ground. Before executing a landing, he fired blanks to clear the landing ground. Upon successful completion of the landing, the soldier crawled through several rows of barbed wire, then executed an obstacle course of ditches, pits, charred walls, and a water obstacle. At the conclusion of the course, the soldier negotiated a rope bridge over a burning oil fire while shooting his weapon at designated targets on the other side of the water obstacle.⁴ These branch specific biathlons had clearly defined time and

assessment criteria and were generally considered the toughest aspects of the Soviet physical training program.

In assessing U.S. Army physical fitness, Major Hertling makes at least one dangerous assertion by assuming that U.S. Army physical fitness programs are built around the PT test. Though this may be his observation, he did not support this with a collection of evidence that would verify that units throughout the Army had indeed made that the base of their program.

Interestingly enough, in the 1986 version of FM 21-20 (the year before he wrote this monograph), physical fitness “readiness” is emphasized over “fitness.” As a matter of fact, it was in the 1986 version in which the Army physical readiness test was changed to Army physical fitness test. This was done in part because the Army’s physical fitness doctrine writers realized that the APFT in its current form (the one used today) was not an accurate assessment of combat readiness.⁵

Another SAMS monograph, this one titled “Too Fat to Fight--Too Weak to Win, soldier fitness in the future?” by Major Mark Foreman, examines the relationship between the United States Army physical fitness program and the physical combat readiness of the combat arms soldier. In this study, he examines some of the physical demands that various combat arms soldiers are placed under, and like Hertling, concludes that the APFT is not an accurate measure of combat fitness levels required for combat. In his conclusion, he states that “only a thread of linkage exists between the U.S. Army’s physical fitness program and the combat arms soldier’s combat readiness.”

Like Hertling, Forman makes assumptions about the state of combat arms physical training programs. It is not known whether or not these are as a result of his

own observations, but it would appear that to substantiate this claim would further strengthen his argument. Additionally, his assessment of AR 350-41, *Training in Units*, differs sharply with the assessment presented in chapter 1 of this thesis. Forman believes that the regulatory guidance, which does purport to support combat readiness, undermines itself with a list of inadequate qualifiers. His recommendation is that to overcome the current program deficiencies, the Army must increase accession standards, improve organizational training, and establish combat physical standards based on combat requirements, not general wellness.⁶

A thesis written by Major Michael Pemrick addresses the components of physical fitness and the mission of the Rangers in the 75th Ranger Regiment. Specifically, Major Pemrick seeks to determine whether the physical training that Rangers conducted and the standards they were required to meet were an accurate reflection of the things they are expected to execute in combat. He determined that although members of the 75th Ranger Regiment are physically fit, their physical fitness training did not reflect the strength, flexibility, coordination, and speed demands of combat. Additionally, Major Pemrick noted that this deficiency is complicated by assessment tools that do not adequately measure demands that will be expected of the soldier on the battlefield. Though more limited in scope than the research question posed in this thesis, there are many great points of consideration and deductions that result from Major Pemrick's work.

Additionally, a Master of Military Art and Science thesis entitled "Amphibious Assault: How fit are our Marines?" essentially examines the same question asked in this thesis regarding light infantrymen and their ability to conduct their wartime tasks. In Major John McLean's thesis on Marines, he argues that the Marine physical fitness test

was not an accurate measure of Marine combat physical readiness and proposed a list of six tasks that related specifically to the conduct of an amphibious assault. From his analysis, he determined representative events that provided better assessments for these required skills. However, though these skills adequately represent tasks needed to accomplish an amphibious assault, they do not correlate with any missions a Marine is expected to complete upon the completion of the amphibious assault. The equivalent to doing that with a light infantryman would be to identify all the tasks necessary for the successful accomplishment of an air assault, while ignoring all the work the infantryman conducted once he got on the ground. Though this would adequately prepare soldiers for one part of the mission, it might miss critical tasks that deserved training to successfully complete other aspects of the mission.

Physical Demands of Combat

In the pursuit of identifying the physical demands of combat, several varied sources helped identify requirements placed on the light infantryman.

In a 1990 article from *Infantry Magazine*, entitled “Load Carrying Ability Through Physical Fitness Training,” the authors discuss recommended doctrinal carrying weights versus data collected at the Joint Readiness Training Center. Though the Infantry school recommends a maximum of 72 pounds for approach marches and 48 pounds for combat actions, the authors determined that weights actually carried during simulated battle at JRTC were far greater. They found that occasionally units carry an average of 99 pounds per individual and the most extreme loads were as high as 167 pounds. They conclude by saying that heavy loads are the reality of the modern day

battlefield and that despite the availability of transport, the need to carry heavy loads will remain.⁷

The Army has studied and published some combat and duty-related soldier physical performance standards. For example, U.S. AR 611-201, *Enlisted Career Management Fields (CMF) and Military Occupational Specialties (MOS)*, specifies that infantrymen (CMF 11) are required to possess the following abilities: (1) to raise and carry a 160-pound person on their back, (2) walk, run, crawl, and climb over varying terrain for a distance up to 25 miles, and (3) carry a minimum of 65 pounds evenly distributed over the entire body. Though a nominal requirement for infantryman, these standards were denoted to select soldiers capable of performing these tasks. Though these tasks are a stated requirement, there is no directed assessment tied to ensuring that each infantryman can perform them. As a result, unless a unit chooses to assess these or similar tasks, there is no practical enforcement of these regulations.

An article written by Marine Major Brian McGuire published in the February 2001 issue of Marine Corps Gazette emphasizes the need for training as you fight by placing greater emphasis on mobility training as a part of unit physical fitness training. Though written from a Marine perspective, his analysis is valuable and applicable to U.S. Army soldiers.

Major McGuire begins by discussing the three planes in which the human body moves. In the sagittal plane of motion, the body is divided into right and left.⁸ Walking, nodding, and reaching overhead all constitute motion primarily in the sagittal plane. In the transverse plane of motion, the body is divided into upper and lower.⁹ Swinging a baseball bat, twisting open a jar, and turning the head to the right and left all replicate

movement in the transverse plane. Lastly, movement occurs in the frontal plane of motion. In this plane, movement is divided into front and back. Common movements in the frontal plane include the side straddle hop and putting the hands on the hips.¹⁰

Though movement can be defined in three planes of motion, most human movement and most battlefield tasks are multiplanar (more than one plane). As a result, Major McGuire asserts that physical fitness programs must be more multiplanar and mobility oriented. In defense of this theory, he argues that the emphasis on the Marine physical fitness, which test events (pull-ups, crunch, and three mile run) that occur in predominantly the sagittal plane, detracts from more mobility-oriented physical training. Like FM 21-20, Major McGuire asserts that “Among other exercises designed to increase mobility, guerrilla and grass drills are considered some of the most challenging and functional means to train for combat-related skills.”¹¹ He summarizes by saying that mobility is a component of fitness that is essential in combat and cannot afford to be overlooked in the development of physical training programs.

To gain an understanding of the physical demands often placed on light infantrymen, several sources have provided valuable insight. The first of these, a battle analysis written by Captain Charles Ferry, a member of 2-14 Infantry, 10th Mountain Division, recounts his unit’s battle to rescue Task Force (TF) Ranger in Mogadishu, Somalia on 3 October 1993. Serving as a company executive officer, Captain Ferry shows insight into the many leader concerns, yet was so close to the battle that he was actually a part of the fighting. Fighting in a built-up environment (urban combat), in a third-world nation, is a scenario that all light infantry units are preparing to fight. Additionally, a series of articles by Captain Ferry’s battalion commander Lieutenant

Colonel David published in *Infantry* magazine, expand the scope of the deployment beyond 3 October 1993 and looks specifically into the physical demands placed on the unit's soldiers.

In a more traditional sense, Lieutenant General Harold Moore's book *We Were Soldiers Once and Young* explores the demands placed on one unit that found itself deep in enemy territory, against an enemy superior in numbers during the early stages of the Vietnam War. His accounts of the fighting provide a vivid portrait of the extreme physical and mental duress that can be placed on soldiers in a combat environment.

As a result of Army-wide interest in both physical fitness and combat readiness, there has been much discussion since the 1992 publication of FM 21-20 concerning preparing units and individuals for combat. This has taken the form of initiatives by the Army Physical Fitness School, Army Physical Fitness Research Institute, Center for Army Lessons Learned, and Army Research Institute. Literature published by these institutions also will impact this study but currently represent a gap that this thesis is aiming to fill. Additionally, this thesis seeks to determine whether or not light infantry units include the combat focus necessary in their physical training programs. Detailed discussion of this information has not been published and as a result, will require the use of a survey to make an accurate assessment. The population will include Command and General Staff College and CAS3 students who have served in light infantry units within the past six years and soldiers, NCOs, and officers currently serving in light infantry units.

¹Department of the Army, AR 350-41, *Training In Units* (Washington, DC: HQs Department of the Army, 1993), 17.

²Major Mark P. Hertling, “Physical Training for the Modern Battlefield: Are We Tough Enough?” (School of Advanced Military Studies Monograph, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1987), 23.

³*Ibid.*, 23.

⁴*Ibid.*, 24.

⁵Major Mark R. Forman, “Too Fat to Fight--Too Weak to Win, Soldier Fitness in the Future?” School of Advanced Military Studies Monograph, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1997), 47.

⁶*Ibid.*, 14.

⁷Michael S. Bahrke and LTC John S. O’Conner, USA. “Load Carrying Ability Through Physical Fitness Training,” *Infantry*, March-April 1990, 34.

⁸Major Brian McGuire, USMC, “Mobility: A Forgotten Component of Marine Corps PT,” *Marine Corps Gazette* (February 2001), 21.

⁹*Ibid.*, 21.

¹⁰*Ibid.*, 22.

¹¹*Ibid.*

CHAPTER 3

RESEARCH METHODOLOGY

This thesis ultimately seeks to determine whether light infantry physical training programs include the necessary combat focus to adequately prepare soldiers for the rigors of combat. The study and research will be conducted over five phases and require a qualitative approach and evaluation. The results from the phases will be used to draw comparisons and make conclusions, and ultimately, answer the primary question.

The first phase will determine the most physically demanding individual tasks light infantrymen are expected to perform on the battlefield. The second phase will assess those tasks identified against the components of physical readiness--strength, endurance, and mobility. In phase three, surveys will be used to determine the tasks currently being trained in light infantry physical training programs. In phase four, those light infantry physical fitness tasks will be assessed against the components of physical readiness. And finally, in phase five, comparisons and conclusions will be drawn.

The first requirement is to determine what tasks light infantry soldiers are expected to execute on the battlefield. Though history is replete with examples, physical tasks will be identified by analyzing the missions light infantry units are asked to perform and from that, determining physically demanding individual tasks the light infantryman is likely to perform on the battlefield. Historical examples are used only to reinforce the need for physically-ready light infantry soldiers and will not be used to define those specific tasks light infantrymen perform in combat.

Units prioritize training by developing a mission essential task list (METL). A METL provides the required focus necessary to train to, and maintain, proficiency. Units cannot be proficient at every potential task they might be expected to perform on the battlefield. By defining METL tasks, a commander gives his subordinates a set number of tasks that he suspects are most likely to be executed in combat, and therefore require proficiency if the unit is to be successful. Collective tasks can be identified which support these METL tasks, and from those collective tasks, a set of accompanying individual tasks can also be identified. By studying each METL task in this way, a set of physically demanding tasks performed most frequently will result from the analysis.

The second phase will analyze the physically demanding tasks identified in phase one against the components of physical readiness. The Army Physical Fitness School, which is currently revising FM 21-20, has defined the components of physical readiness as strength, endurance, and mobility (this chapter was last updated 28 November 2000, but has not yet been published). Mobility is further comprised of a number of other qualitative performance factors that include agility, balance, coordination, flexibility, stability, speed, and power. Though strength and endurance are obvious necessities for an infantryman, mobility as a necessary component may not be as clear. The following examples reveal the relationship that mobility shares with strength and endurance.

Mobility is the functional application of strength and endurance.¹ In practical terms, strength and mobility allow the infantryman to squat low in order to achieve a good position to evacuate a casualty. Without sufficient mobility, a strong soldier will have difficulty executing the same casualty evacuation technique. Likewise, endurance without mobility may be fine for a distance runner, but for light infantry soldiers

performing individual movement techniques (IMT), both components are essential for success.²

With the help of a sports physiologist, the identified physically demanding tasks will be evaluated to determine their requirements for endurance, strength, and mobility. This analysis will show the demands each task requires in regard to each of the components of physical readiness. The resulting analysis will demonstrate the relationship of these tasks with the components of physical readiness. It will also reveal the physical readiness components that play the greatest roles in the execution of light infantry combat tasks.

Determining the makeup of current light infantry physical training programs will require the use of a questionnaire or survey. As a result of the limited time and resources available, it is not feasible to use a control group or study the physical training program of light infantry units. The survey bridges the gap in data that would normally be provided by a control group and should reflect a representative sample of the tasks being executed in light infantry physical training programs and the frequency with which they are executed. Surveys will be distributed to CGSC and CAS3 officers who have served in light infantry units in the last six years, and will be mailed to officers, NCOs, and enlisted soldiers currently serving in each light infantry brigade. Surveys will only attempt to determine what light infantry units are doing and the frequency at which certain events are done, and will not ask nebulous questions or use language to lead the respondent (i.e., What “combat-focused” physical training events does your unit execute). From the surveys, tasks performed most frequently in light infantry units will be identified and assessed in terms of the components of physical readiness. The risk,

however, is in assuming that the data received can be accurately reduced to a common set of six to eight tasks that most units are executing with some frequency. Several factors lend credibility to the fact that the programs can probably be reduced to a common set of tasks or events. The first, and most obvious, is that all soldiers in the U.S. Army are subject to the same doctrinal guidance (FM 21-20) and to the same physical fitness test, which in part, would tend to lead to commonality between programs. Additionally, almost all NCO and officer education is centralized. NCOs learn physical fitness training during basic training, the Primary Leadership Development Course (PLDC), the Basic Non-Commissioned Officer Course (BNCOC), and the Advanced Non-Commissioned Officer Course (ANCOC)--all centralized programs. Infantry officers learn physical fitness basics at the Infantry Officer Basic Course (IOBC), also a centralized course. Lastly, with the personnel turbulence purposely created in the Army, new NCOs and officers, and the introduction of new ideas brought with them, is commonplace. Good ideas and strategies are not confined to one locale or one unit.

In phase four, the representative tasks (tasks executed most frequently in light infantry physical training programs) will be evaluated against the same physical readiness components used to evaluate the physically demanding individual tasks from phase one. Once again, this assessment will demonstrate the relationship of these tasks with the components of physical readiness. A close analysis should reveal strengths and weaknesses in the program as it relates to the components of physical readiness. Strong programs--ones that are combat-focused--should show demand across the spectrum of the components of physical readiness to a similar degree as the combat tasks. Programs not

combat-focused will most likely reveal discrepancies, or areas where a component is or components are being neglected or over-emphasized.

The final phase will compare the outcomes from the analysis of the METL- deduced physically-demanding individual tasks with the outcomes of the tasks derived from what light infantry battalions are currently doing. This comparison will answer the question of whether light infantry programs are adequately preparing their soldiers for the rigors of combat, and if they are not, identify specifically those areas that need improvement or emphasis. Following the analysis, conclusions and recommendations will suggest courses of action to further strengthen existing programs or discuss strengths that resulted in programs meeting the combat-focused requirement.

¹Department of the Army, FM 3-25.20 (Draft), *Physical Fitness Training*, 2-2. Available on the internet at <http://www.benning.army.mil/usapfs/Doctrine/FM21-202000/index.htm>; from internet.

²Ibid., 2-3.

CHAPTER 4

ANALYSIS

Every soldier, leader, and unit training program must be carefully planned, aggressively executed, and thoroughly assessed.

General Carl E. Vuono

Certainly, it would be convenient if every potentially physically demanding task on the battlefield could be predicted, and therefore, prepared for. Unfortunately, the battlefield is a complex and fluid environment that is impacted by numerous factors outside the control of any unit or leader, and as a result, will always be clouded with disorder and uncertainty. Factors, such as terrain, time, climate, and certainly the enemy, will always impact the demands placed on a soldier in combat. However, a unit can predict with some degree of certainty the missions it will be asked to perform in combat. Knowing those missions, it is possible to determine likely physical requirements that are derived from the individual tasks required of soldiers to successfully perform those missions. In obtaining “physical readiness,” units should focus on developing components of physical readiness that support the tasks they will be asked to perform in combat. This chapter will focus on the following: identification of physically demanding individual tasks through mission essential task list (METL) analysis, assessment of each demanding individual task in regard to the components of physical readiness (muscular strength, muscular endurance, aerobic endurance, anaerobic endurance, and mobility), identification of tasks executed most frequently in light infantry physical training programs, and assessment of those tasks in regard to physical readiness components. Completion of the above analysis will facilitate comparison between the physical readiness requirements of combat tasks and the physical readiness components of tasks

executed as a part of unit physical training. This comparison will facilitate answering the primary question--do light infantry physical training programs include the combat focus necessary to prepare soldiers for combat.

Within units, commanders must selectively identify those tasks that are essential to accomplishing the organization's wartime mission. Those tasks that are deemed critical to the accomplishment of the wartime mission are combined to form the Mission Essential Task List (METL) for that unit. In today's army, with increased demands on the resources and time available for training and with the personnel turbulence of an all-volunteer Army, a METL gives units the focus it needs to prepare leaders and soldiers for a finite number of missions. The establishment of a METL allows the commander to narrow the training requirements to an achievable number, understanding that it is not possible to obtain proficiency on every possible task. The METLs are not prioritized and preparation for one task should not dominate the focus of the training effort at the expense of other tasks. A unit is expected to maintain proficiency on all METL tasks, and commanders report an assessment of their training on these specific tasks at least quarterly. The company is the lowest level that determines a METL and as a result, serves as the base from which the thesis own analysis will begin.

The mission of the infantry is to close with the enemy by fire and maneuver in order to repel his attack by fire, close combat, or counterattack.² With essentially the same organization, capabilities, limitations, and leaders and soldiers with almost identical doctrinal training backgrounds, it should be expected that light infantry companies would execute similar missions on the battlefield. It is not surprising then that light infantry companies generally share a common set of core tasks reflected in their METL.

Additionally, the Army’s infantry airborne and air assault units, while using different means to arrive at the battlefield, are also expected to perform these same core tasks once they arrive at the battlefield.

By contacting representatives from each light infantry brigade or division, a METL for each unit’s rifle companies was obtained. A comparison of light infantry, airborne, and air assault company METL tasks reveals the similarity discussed above.

Table 1. Rifle Company METL Comparison

| | 10th Mtn Div | 25th Inf Div | 82nd Abn Div | 101st Abn Div | 172nd Inf Bde | 173rd Abn Bde | 2nd ID |
|------------------------------|--------------|--------------|--------------|---------------|---------------|---------------|--------|
| Execute Defense | X | X | X | X | X | X | X |
| Execute Attack | X | X | X | X | X | X | X |
| Assault Built-Up Area (MOUT) | X | X | X | X | X | X | X |
| Conduct Marshalling Opns | X | | X | | X | X | X |
| Perform Abn Assault | | | X | | X | X | |
| Perform Air Assault | X | X | X | X | | X | X |
| Prep For Combat | | | X | | | | |
| Perform Mvmt to Contact | | | X | | | | |
| Defend MOUT | | | | X | | | |
| Perform OW/ SBF | | | | X | | | |
| Move Tactically | | | | X | | | X |

Doctrinally, TRADOC and the infantry school have done a superb job in preparing publications that teach soldiers and leaders how to successfully execute these missions. The Army Training and Evaluation Program (ARTEP) series of manuals, specifically ARTEP 7-8 MTP, *Mission Training Plan for the Infantry Rifle Platoon and Squad*, and ARTEP 7-10 MTP, *Mission Training Plan for the Infantry Rifle Company*, not only identify the steps, performance measures, and standards for each company METL task, but also the supporting platoon collective tasks and individual tasks required to perform each METL task. As a result, the identification of supporting individual tasks is not an arbitrary process conducted by the researcher. It is supported by doctrine, which has evolved through the experiences of light infantry forces in past conflicts.

The analysis, therefore, needed to identify demanding individual tasks is almost identical to the process followed by any leader in preparation for training. A company that wishes to train the METL task “execute defense” cannot go to the field and execute it successfully without ensuring that the subordinate platoon collective tasks, plus supporting individual and leader tasks, have been identified and trained prior to the actual execution of training. If the individuals do not know how to properly construct an individual fighting position (an essential individual task that supports the platoon collective task "defend"), then success in execution of the larger task, defend, is much less likely. It is this same methodology that is applied to the identification of demanding individual tasks. In this same scenario, if “digging” an individual fighting position and “carrying” sandbags and other barrier material are essential in the preparation of the defense, then to be successful, the individuals must be physically prepared to conduct this task. If as a result of poor physical fitness soldiers cannot properly dig their fighting

positions, then fill and carry sandbags, then their defensive position and the unit's defense will not be prepared to standard. Preparing a defensive position to standard is essential in successfully surviving and defeating the enemy's assault. A similar comparison can be made to the METL task "execute attack." A critical individual task in the execution of the attack is "move as a member of a fire team." If asked in the course of the attack to conduct a long infiltration or foot march, then soldiers must be conditioned to execute this task. If a commander loses a large number of soldiers due to a physical inability to move the distance required or carry the equipment required, the unit's ability to accomplish the mission is potentially compromised. In peacetime, the failure to perform these tasks as a result of an inadequate physical readiness level might lead to unsuccessful completion of the mission. In combat, the inability to perform these tasks could not only result in mission failure, but also loss of life.

From the rifle company METL comparison table, a set of common rifle company METL tasks is identified. This list includes:

1. Execute Defense
2. Execute Attack
3. Assault Built-Up Area (MOUT)
4. Conduct Marshalling Operations (NEO)

Within a rifle company, leaders must analyze the company METL tasks to determine which supporting platoon collective tasks, leader tasks, and individual tasks are essential to accomplish each company METL task. The supporting platoon collective tasks, though not defined as a METL at the platoon level, become the focus for the platoon's training. Successful accomplishment of these subordinate collective, leader,

and individual tasks results in mission success at the higher level. In some cases, the tasks at platoon and company level are almost identical except that differently sized units (platoon versus company) perform them. For other tasks, a series of collective tasks leads to the accomplishment of a single METL task. In these cases, a subordinate element may not be equipped, have the necessary manpower, or the appropriate leadership necessary to conduct the tasks. Further analysis of common rifle company METL tasks reveals the following platoon collective tasks:

1. Move Tactically
2. Execute Defense
3. Execute Attack
4. Perform Initial Breach of a mined wire obstacle
5. Enter and Clear a Trench
6. Knock out a Bunker
7. Enter and Clear a Building
8. Perform Overwatch and Support By Fire
9. Establish a Roadblock/checkpoint
10. React to Contact
11. Treat and Evacuate a Casualty

These collective tasks serve to focus the platoon's training effort and are essential to the success of the larger company level tasks. The ARTEP 7-8, *Mission Training Plan (MTP) for the Infantry Rifle Platoon and Squad*, establishes the standard of conduct for each of these collective tasks. Additionally, ARTEP 7-8 MTP identifies the individual tasks (both common to all soldiers and those specific to light infantry (11B)) that must be

accomplished successfully to execute the platoon collective task. Individual tasks fall into several categories. They can be of a technical nature (i.e., zero an M16 rifle), an intellectual nature (i.e., estimate range), or a physical nature (i.e., move under direct fire). In support of this thesis, identification of physically demanding tasks is critical to the determination of each component of physical readiness required. An analysis of each platoon collective task identifies a set of physically demanding individual tasks.

Move Tactically

Squads, platoons, and companies all have a requirement to move tactically. A tactical movement is an integral part of any mission, to include the defense. A tactical movement can occur across a wide spectrum of environments--dense jungle, open terrain, built-up areas, and mountainous terrain. Leaders select movement formations based on the likelihood of enemy contact, and this impacts the rate at which a unit moves. Units normally conduct tactical movements with all mission essential equipment, to include load-bearing equipment (LCE), kevlar helmet, rucksack, and assigned weapon. Often, this requires the soldier to carry a heavy load over a long distance.

The MTP identifies demanding individual tasks that support a tactical movement:

Table 2. Move Tactically Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| | |
| <u>11B Task No.</u> | <u>Task</u> |
| B48 | Move as a Member of a Fire Team |
| B49 | Perform Movement Techniques During MOUT |

Execute Defense

Platoons execute a defense to defeat an attacker and prevent him from obtaining his objectives. The immediate purpose of the defense is to cause the enemy attack to fail. The ultimate purpose is to achieve the conditions that facilitate assuming the offensive. The advantage the defender assumes is the ability to arrive at a piece of terrain before the attacker and prepare it to his advantage. This includes the construction of individual and crew-served weapon fighting positions, clearing fields of fire, and emplacing obstacles.

In all, over 84 individual tasks support the platoon collective task "defend." Those tasks identified to be physically demanding consist of the ones in table 3.

Table 3. Execute Defense Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|--|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| 70 | Construct an Individual Fighting Position |
| <u>11B Task No.</u> | <u>Task</u> |
| 27 | Construct a Fighting Position for an M47 Med Antitank Weapon |

Execute Attack

An attack is an offensive action characterized by movement supported by fire. Infantry platoons can conduct attacks on their own, or as part of a larger force. Raids, ambushes, and hasty/deliberate attacks all share essentially the same characteristics and

seek to achieve the same results--shatter the enemy's nerve, disrupt his synchronization, and destroy his willingness to fight.

The platoon collective task "attack" requires the successful execution of 64 individual tasks. Like defend, there are a variety of individual tasks of which only a percentage require physically demanding work be done. These tasks are listed in table 4.

able 4. Execute Attack Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| | |
| <u>11B Task No.</u> | <u>Task</u> |
| B48 | Move as a Member of a Fire Team |

Perform Initial Breach of a Mined Wire Obstacle

A breach is the employment of any means available to break through or secure a passage through an enemy obstacle. Platoons and squads conduct breaches of mined wire obstacles as part of a larger element. The platoon breaches different obstacles employing varied techniques, types of equipment, and explosives. Both friendly and enemy doctrine stresses covering obstacles with direct and indirect fire. As a result, breaching operations are normally characterized by the establishment of overwhelming suppressive fire against the enemy, obscuration of the area to be breached, a rapid assault to the obstacle (normally while taking direct fire) by an element to establish the breach, and an assault through the breach to secure the far side.

The physically demanding individual tasks listed in table 5 support the task "conduct breach of a mined wire obstacle."

Table 5. Conduct Breach of a Mined Wire Obstacle Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| <u>11B Task No.</u> | <u>Task</u> |
| B48 | Move as a Member of a Fire Team |

Enter and Clear a Trench

Platoons and squads enter and clear trenches generally as part of a larger force in the conduct of an attack. In seizing a trenchline, an element suppresses the enemy on the objective, while a subsequent element conducts individual movement techniques towards the trench to establish a foothold inside the trench. Once a foothold is established, additional forces flow into the trench to build combat power and defeat the enemy. Trench fighting is characterized by close fighting (usually 50 meters or less), and restrictive terrain that makes enemy identification difficult and reduces the flexibility of the assaulting force.

Physically demanding individual tasks in table 6 support "enter and clear a trench:"

Table 6. Enter and Clear a Trench Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| <u>11B Task No.</u> | <u>Task</u> |
| B48 | Move as a Member of a Fire Team |

Knock Out a Bunker

Like the trench, a bunker is normally destroyed as part of an attack by a larger force. A platoon or squad can generally knock out a single bunker, depending on the enemy situation and size of the bunker. In attacking a bunker, one element lays down a base of fire to suppress enemy within the bunker, preventing the enemy from detecting and engaging the assault force. An assault force moves to a location from which it can assault the bunker and remain undetected from the enemy within it (normally the blind side). The assault is conducted using individual movement techniques (IMT), fire and maneuver. Once the assault force reaches the bunker, it temporarily disables the enemy with a hand grenade, then follows with a force that clears the room with direct fire.

Table 7 lists the demanding individual tasks that support the collective task "knock out a bunker:"

Table 7. Knock Out a Bunker Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| <u>11B Task No.</u> | <u>Task</u> |
| <u>B48</u> | <u>Move as a Member of a Fire Team</u> |

Enter and Clear a Building

The light infantry platoon normally conducts the task "enter and clear a building" as part of a larger force which is conducting an assault of a built-up area. In the conduct

of this mission, an element suppresses the enemy in and around the building while another element assaults towards the building using IMT to secure a foothold. Once an initial foothold is established, the unit flows forces to clear additional rooms within the building, or to prepare to assault into another building.

Enemy forces defending buildings often barricade doors and windows, especially those on the first floor. As a result, this often means that it is most difficult to establish a foothold by climbing through a window or attacking through a first floor door or window. Doctrine teaches, therefore, to start high and work down when possible. Units attempt to get into second floors, or higher, through a variety of techniques, to include climbing or catapulting.

Fighting in buildings is characterized by close combat and a series of room-to-room battles fought at the team and squad level. Restricted terrain in buildings--stairwells, hallways, and doorways--gives a significant advantage to the defender.

Demanding individual tasks that support the collective task "enter and clear a building" are listed in table 8.

Table 8. Enter and Clear a Building Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| <u>11B Task No.</u> | <u>Task</u> |
| B48 | Move as a Member of a Fire Team |
| B49 | Perform Movement Techniques During MOUT |

Perform Overwatch and Support by Fire

The task perform overwatch and support by fire can be conducted at the squad, platoon or company level (figure 9). In the conduct of this task, the platoon overwatches or supports by fire the movement or assault of an objective by another friendly unit. The purpose is to suppress, or be prepared to suppress, targets of opportunity that might otherwise interfere with the movement or assault towards the objective. At times, the support element must fight to the piece of ground from which it will provide overwatch or support. Additionally, the element seeks to obtain a piece of terrain that dominates the area over which it will provide support. As a result, the support element normally remain stationary, making it vulnerable to indirect fires and attacks.

Table 9. Perform Overwatch and Support by Fire Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| <u>11B Task No.</u> | <u>Task</u> |
| B48 | Move as a Member of a Fire Team |

Establish a Roadblock or Checkpoint

Establishment of a roadblock or checkpoint is a critical subordinate task supporting the company METL “Conduct Marshalling and Security Operations.” Roadblocks and checkpoints are established to control the flow of both personnel and vehicular traffic through a given area of operations. The key subordinate tasks include

enforcing rules of engagement (ROE), constructing obstacles to restrict the flow of traffic, and designating areas for searches. The MTP does not identify any demanding individual tasks for this collective task. As a result, it will not be studied further.

Movement to Contact

Platoons and squads perform movements to contact to regain contact with the enemy. During movement, the platoon or squad must be prepared to make contact, then maneuver to develop the situation. If contact is made with an inferior force, the platoon may decide to conduct a hasty attack to destroy or defeat the opponent. If contact is made with a larger force, the platoon can break contact and withdraw, or lay down a base of fire and ask for reinforcements.

Because the enemy situation is not developed, platoons must often carry their equipment with them. This often means that platoons will move long distances, carrying heavy loads, and have to be prepared to react to enemy direct and indirect fire while wearing this equipment. Once in contact, the platoon can ground its equipment.

Table 10. Movement to Contact Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| <u>11B Task #</u> | <u>Task</u> |
| <u>B48</u> | <u>Move as a Member of a Fire Team</u> |

Treat and Evacuate a Casualty

Treating and evacuating casualties is an integral part of any mission or operation.

Though ideally, a well-planned and executed mission will reduce casualties, the burden for treating and evacuating casualties that do occur cannot be assumed by the medics alone. In a 39-man light infantry platoon, only one medic is attached to support the platoon. His mission is to assess and treat casualties. The burden for evacuation, therefore, falls on the shoulders of the remaining light infantrymen.

The demanding individual tasks that support the task “treat and evacuate a casualty” and in table 11.

Table 11. Treat and Evacuate a Casualty Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|---|
| 90 | <u>Transport a Casualty Using a One-Man Carry</u> |
| 91 | <u>Transport a Casualty Using a Two-Man Carry or an improvised litter</u> |
| <u>11B Task #</u> | <u>Task</u> |
| None | |

A roll-up of the demanding individual tasks that support the platoon collective tasks reveals a surprising parallel. It is important to remember that not all individual tasks have been reflected, only those that are deemed to be physically demanding. As one quickly determines, a core group of demanding individual tasks is common to almost all of the platoon collective tasks. A closer evaluation of the demanding individual tasks reveals why. The U.S. Army is offensive in nature. Light infantrymen, on the offensive, close with and destroy the enemy. Many of the demanding individual tasks are generated

as a result of close contact with the enemy or as a result of enemy resistance. The identified demanding individual tasks are in table 12.

Table 12. Summary of Physically Demanding Individual Tasks

| <u>Common Task No.</u> | <u>Task</u> |
|------------------------|--|
| 64 | Move Under Direct Fire |
| 65 | Move Over, Through, or Around Obstacles |
| 66 | React to Indirect Fire While Dismounted |
| B48 | Move as a Member of a Fire Team |
| B49 | Perform Movement Techniques During MOUT |
| 70 | Construct an Individual Fighting Position |
| 90 | Transport a Casualty Using a One-Man Carry |
| 91 | Transport a Casualty Using a Two-Man Carry or an improvised litter |
| B27 | Construct a Fighting Position for an M47 Med Antitank Weapon |

Of the tasks identified above, Construct a Fighting Position for an M47 Medium Antitank Weapon will not be considered for two reasons. The first reason regards the tasks similarity to construct an individual fighting position. Both tasks place the same physical demands on a soldier, but are identified separately because the M47 is a bipod fired weapon, fired from the shoulder, which requires the fighting position contain characteristics unique to the weapon. Secondly, the M47 is no longer the medium antitank weapon being used in light infantry battalions. It has been replaced by the Javelin--which does not contain bipod legs. Because the task does not place a unique physical demand on the soldier, it can be eliminated from consideration.

The Soldier's Manual of Common Tasks, Skill Level 1 (SMCT 21-1-SMCT), very similarly to the ARTEP manuals identified earlier, provides the specific standard for the

execution of each of these individual tasks. Additionally, a study of the performance measures required to conduct the task will also reveal the specific demands that the task places on the body.

Move Under Direct Fire

The task move under direct fire examines those individual movement techniques a light infantry soldier employs once under direct fire from the enemy. The soldier, who is moving as part of a team, either fires in support of another team member's movement, or moves forward to the next covered and concealed position as his team moves to defeat the enemy. As the soldier begins to move, he must select a route that provides the best available cover and concealment without masking the fires that are covering his movement. Based on the viability of the route, the soldier must be prepared to conduct a three-to-five second rush (very good covered and concealed route), execute a high crawl (moderately covered and concealed route), or a low crawl (very poorly covered and concealed route). These movement techniques are conducted while wearing kevlar helmet, LCE, and carrying a weapon, but without the additional burden of a rucksack.

The three-to-five second rush requires a soldier to rise up from a prone firing position, rush forward to the next covered and concealed position, stop and plant both feet, then fall forward--rolling onto the nonfiring side of the body. This must be done as quickly and efficiently as possible, remembering that the enemy is actively attempting to engage the individual with direct fire.

The high crawl requires the soldier to keep his body off of the ground, resting the weight on the forearms and lower legs. The weapon is cradled in the arms with the muzzle off of the ground. The knees are kept well behind the buttocks so it stays low.

The soldier advances forward by alternatively advancing the right elbow and left knee, then left elbow and right knee.

When low crawling, the soldier keeps his body as flat and as close to the ground as possible. The weapon is carried by grasping the upper sling level, then allowing the handguard to rest on the forearm with the butt of the weapon on the ground. The soldier moves forward by a combination of pushing and pulling movements with the arms and legs.

Demanding Physical Tasks: Three-to-Five Second Rush, High Crawl and Low Crawl

Move Over, Through, or Around Obstacles

Moving over, through, or around obstacles addresses negotiating various obstacles and danger areas that are encountered when conducting a tactical movement. In negotiating obstacles and danger areas, soldiers must be prepared to execute this task while carrying all of their assigned equipment--to include rucksack. As defined by the SMCT, these obstacles and danger areas may be natural (streams or open areas) or man-made (walls or wire entanglements).

When crossing a man-made obstacle, the SMCT directs checking the obstacle for booby traps, then making one of three decisions regarding negotiating the obstacle--crossing over it, cutting through it, or crossing under it. Crossing over the obstacle requires a mat or piece of material that protects the individual from the wire. If in his possession, the soldier places the mat on the wire, then crosses by walking or falling over onto the mat. To cut through the obstacle requires a tool (i.e., wire or bolt cutters) that can cut through the object impeding movement. Crossing under the obstacle requires an

obstacles that provides some clearance. If this clearance exists, the soldier is instructed to slide on his back, push his weapon forward against the wire to prevent it from catching on his skin or clothing, then push with his legs and heels while maneuvering the shoulders. This movement is almost identical to the low crawl, except it is executed on the back, not the stomach.

When crossing an upright man-made obstacle, the SMCT directs the soldier to climb quickly over the top, then rolling over the peak quickly to prevent silhouetting the body.

Lastly, when crossing an open or danger area, the SMCT directs crawling (high or low crawl) up to the edge of the danger area, observing the far side carefully before crossing, then running rapidly, but quietly, across the area.

Demanding Physical Tasks: High Crawl/Low Crawl, Run, Climb

Move as a Member of a Fire Team

Movement is an infantry essential task that is common to all missions and operations. Infantrymen do not move to the battlefield alone, they move as teams, squads, and platoons. Though movement probably sounds simple to the casual observer, numerous factors impact an element's ability to do this well. A platoon's ability to move and not be detected by the enemy, to move efficiently once in contact with the enemy, and to be able to move long distances, carrying a rucksack with mission essential equipment, without losing situational awareness or security, all impacts an infantryman's effectiveness on the battlefield.

The STP 7-11BCHM1-SM-TG defines the standard for movement of a fire team. This task is largely technical in nature. The leader directs one of four formations

dependent on the enemy, terrain, and visibility. The formations are the wedge, the modified wedge, the diamond, and file. To prevent detection from the enemy, and to protect soldiers in the event of indirect fire, intervals between individuals normally remain about ten meters during daylight but increase in open terrain and decrease during limited visibility. Soldiers moving as a part of a team maintain security to the front, rear, and flanks, are prepared to stop at danger areas, for breaks, or when the enemy situation dictates, and cross-level heavy loads during long movements to prevent any one individual from becoming overly fatigued.

Demanding Physical Tasks: Foot March

Perform Movement Techniques during MOUT

Individual, fire team, and squad movement techniques within an urban environment differ slightly than those in most conventional operations. In most operations, a squad or platoon makes contact with the enemy, develops the situation, attempts to establish a base of fire, and then maneuvers to destroy the enemy. In these situations, friendly forces suppress the enemy to the front, while another friendly element attempts to flank or envelop the enemy. For the most part, however, the threat is contained to the front. The enemy's movement laterally is diminished by the effects of friendly weapon systems. In an urban environment, the fight becomes three-dimensional. Soldiers must not only be wary of fire from the front, but also from above (rooftops), below (basement windows and sewers), the flanks, and rear. Because urban areas are so compartmentalized, the effects of weapons in support are diminished by shorter distances, an inability to detect the enemy, and an inability to penetrate walls and other structures.

In moving in a MOUT environment, the STP 7-11BCHM1-SM-TG directs soldiers to make a visual reconnaissance of the area they will bound to, select a covered and concealed route, move in the most direct route possible, and move without masking covering fires. During movement, emphasis is placed on sprinting to reduce the total time with which the enemy might be able to detect and engage a soldier. When crossing walls or fences, the STP directs that soldiers check the top for booby traps, scale the wall quickly, and present the smallest silhouette possible when climbing over the top, then move rapidly to the nearest covered and concealed position. Additionally, soldiers must be prepared to climb through first floor openings into a building and up ropes to get into rooms and structures above the first floor. In an urban environment, doorways are the most dangerous places to enter a building. When possible, these should be avoided.

Demanding Physical Task: Climb, Sprint, Run

React to Indirect Fire While Dismounted

Soldiers conducting a tactical movement must always be wary of the enemy's indirect fire capabilities. Generally, at very close ranges, the enemy cannot effectively employ indirect fire without endangering his own troops. As a friendly unit conducts tactical movement along designated routes, approaches an objective area, or consolidates and reorganizes following completion of a mission, it is very vulnerable to indirect fires.

The SMCT directs that soldiers should initially warn their squad and platoon members by shouting incoming as indirect fire begins. Immediately following, with their equipment, they should assume the prone position and high or low crawl to the best available cover. Then following instructions from their leader, the unit will run, with all assigned equipment, away from the impact area of the rounds. This distance, at a

minimum, is generally 300 meters--a distance that ensures the unit is out of the bursting radius of additional rounds.

Demanding Physical Tasks: High Crawl or Low Crawl, Run

Construct an Individual Fighting Position

In preparing an individual fighting position, the soldier must construct a position that is wide enough for his body and equipment, is armpit deep, possesses frontal and overhead cover, and utilizes grenade sumps. Soldiers required to begin construction of fighting positions are given standard pioneer tools or use their assigned entrenching tool (e-tool). To achieve a hole that is armpit deep, the average soldier must dig a hole to at least a depth of three to four feet and at least the same distance wide. Additionally, the standard for frontal and overhead cover is generally achieved by the massing of sandbags. To prevent compromising an individual position, leaders direct that soldiers disturb the terrain as little as possible around the position so that the natural foliage assists in camouflaging the position. As a result, soldiers fill sandbags behind their positions, then carry the sandbags forward to fortify their defensive positions.

Demanding Physical Tasks: Dig, Carry

Transport a Casualty Using a One-Man Carry

The SMCT directs a one-man casualty carry when a soldier has evaluated a casualty and made a determination that he must be evacuated for further medical treatment, and no other soldier is available to assist in the evacuation.

The first step the soldier confronts is simply determining the appropriate carry--of which there are numerous varieties. The fireman's carry, support carry, arms carry,

saddleback carry, pack-strap carry, or pistol belt carry may all be appropriate options dependent on the status of the patient and the enemy situation. Though each is unique in employment, each require that the casualties weight be negotiated, and then carried by the individual. As a result, the demanding individual task the soldier is required to execute is carry.

Demanding Physical Task: Carry

Transport a Casualty Using a Two-Man Carry

The conditions for transporting a soldier using a two-man carry are very similar to the conditions confronted by the one-man carry. In both, a determination has been made to evacuate the casualty after an initial evaluation. The difference, however, is in additional manpower and materials available. The two-man carry requires that a buddy assists in the evacuation and some materials that might make carrying the individual more efficient. Once again, the SMCT offers a wide variety of options--the two-man support carry, the two-man arms carry, the four-hand seat carry, the two-man fore and aft carry, the two-hand seat carry, or the litter carry. Once again, though, each of the options requires that the casualty be carried. The options are provided so that a selection is made which ensure further injury is not incurred during evacuation. As a result, the basic task identified is carry.

Demanding Physical Tasks: Carry

The analysis of individual tasks reveals the following list of mission essential, demanding individual tasks that a light infantry soldier must be prepared to perform on the battlefield.

1. Footmarch
2. Climb
3. Sprint
4. High / Low Crawl
5. Carry
6. Dig
7. Perform three-to-five Second Rush
8. Run

The analysis thus far has shown how demanding individual tasks are derived from the unit's METL. Having identified these tasks, it is now important to determine how much of the physical readiness components--strength, endurance, and mobility--they require. Earlier, the components of physical readiness were identified. They will now be discussed in greater detail and a correlation will be drawn, in terms of the demand required, in comparison to each physically demanding task.

Strength will be discussed in terms of muscular strength. Muscular strength is defined as the greatest amount of force a muscle or muscle group can exert in a single effort.³ An example, in very simple terms, would be an Olympic weightlifter. Olympic weightlifters lift as much as possible in one lift. This requires a great amount of strength. A need for strength in light infantry soldiers is obvious--they carry heavy loads over demanding terrain, carry wounded soldiers, and climb over walls, fences, and other

obstacles. Though other components of physical readiness factor into these events as well, there is no doubt that muscular strength plays a role in most tasks.

Endurance is the second component of physical readiness and is defined as the ability to sustain activity.⁴ Endurance will be further discussed in terms of “muscular endurance,” “aerobic endurance,” and “anaerobic endurance.” Muscular endurance is the ability of a muscle or muscle group to perform repeated movements with a less than maximum (submaximal) force for extended periods of time.⁵ To build on the example above, the ability to perform multiple repetitions with a given weight requires muscular endurance. There is no direct relationship between muscular strength and endurance. One does not equal the other. Aerobic endurance is the ability to participate in sustained arduous physical activity for extended periods and is characterized by continuous, submaximal effort.⁶ A great example of aerobic activity is long distance running. It is, in accordance with the definition, characterized by a repeated and continuous effort that does not require maximum intensity. Anaerobic endurance is the ability to execute high-intensity, short-duration activities over a period of time.⁷ Anaerobic activity is characterized by intermittent activity, executed less frequently but at a higher intensity. An example of a sport or event that requires a large amount of anaerobic endurance is football. Football is violently executed for a short duration, with intermittent breaks between physical activity.

Mobility will be discussed in terms of “motor efficiency” and “flexibility.” Flexibility is the ability to move the joints or group of joints through an entire range of motion and is essential to perform quality movements safely.⁸ Motor efficiency is the ability of the body to perform multiple tasks effectively.⁹ Coordination of arm, leg, and

trunk movements is essential in the performance of many tasks. In soldiers, it is common to see someone physically fit, but with poor motor efficiency. Basketball is an example of a sport which requires motor efficiency. Basketball, with its continuous movement, jumping, dribbling, shooting, and visual scanning, requires a great amount of motor efficiency to be effective.

Having defined the components of physical readiness and provided practical examples, the physically demanding tasks that soldiers must perform on the battlefield will be evaluated to determine the physical readiness components they require. Each task will be evaluated to determine if the demand required in terms of the component is low, medium, or high. None of the physically demanding tasks will be weighted over the other. The analysis will answer two questions: (1) How much of each component of physical readiness is required to perform each physically demanding task? and (2) How much each component of physical readiness contributes to the overall execution of tasks likely to be experienced on the battlefield?

Comparison of Physically Demanding Tasks to Physical Readiness Components

Foot March

Foot marching is the basic staple of the infantryman. Almost every infantry operation requires some form of movement by foot. Foot marches are performed by soldiers with load bearing equipment (LBE), kevlar helmet, individual weapon, and a ruck sack with a varied load. In total, this weight may be anywhere from thirty to ninety pounds. Soldiers must be prepared to perform foot marches in all environments and for long distances.

The foot march measures the local muscular endurance of the leg and back muscles. Additionally, because the road march is a continuous movement requiring submaximal effort, it also measures aerobic endurance. As a result, foot marching demonstrates a high demand for muscular endurance and aerobic endurance.

As discussed above, a soldier's load can be anywhere from thirty to ninety pounds. Lifting this load onto the soldier's back and then carrying it requires strength. It also requires motor efficiency. It is not enough that a soldier is able to get the load onto his back, but he must also be able to move efficiently with the load. This includes movements in a wide variety of environments--mountains, swamps, rolling hills, and deserts. As a result, road marching demonstrates low demands for motor efficiency and muscular strength.

Climb

Light infantrymen are required to climb for a number of reasons. In an urban environment, soldiers are often expected to scale walls and fences, and climb into second and third story windows or balconies. In mountainous terrain, there are scenarios where soldiers are required to climb or scale cliffs. When crossing water obstacles, soldiers are required to perform a horizontal climb across rope bridges.

Climbing demonstrates a high demand for muscular strength, anaerobic strength, flexibility, and motor efficiency. When climbing, soldiers are often required to pull a combined weight greater than that of their body weight into an opening or up a rope. This requires great strength from the biceps and latissimus dorsi ("lat" muscles). Because of the incredible stress placed on the muscles, soldiers are taught techniques for "locking" on a rope, and therefore, providing the arms with an often necessary break before the next

pull and movement upward. Though in an urban environment it will not necessarily be a rope that a soldier is scaling, the intent is the same. The soldier provides maximum intensity as he thrusts upward until provided the opportunity to lock on a rope, rest on a windowsill, or rest on a new foothold. It is the movement itself that places the most stress on the muscles. Because of the intermittent nature of this movement and the fact that a soldier will often have to perform repeated or prolonged climbs (long rope), it requires a lot of anaerobic endurance.¹⁰ Climbing is achieved by several skills coming together to perform a movement. It is the hands, feet, and arms all working together to scale an obstacle. When one does not work in unison with the others, the task is significantly more difficult and usually, not successful. As a result, climbing requires a great deal of motor efficiency. Lastly, flexibility allows the soldier to maximize his technique, and therefore, lessen the chance of injury and reduce fatigue.

Sprint

Sprinting supports Perform Movement Techniques in MOUT and is discussed separately from other movements, to include the three-to-five second rush and run. Sprinting in this thesis involves rapid movement between covered positions. In an urban environment, as the assaulting force begins to assault into the city, movement techniques change from high/low crawl and three-to-five second rush, to more rapid movements between places of cover. Generally, once in a covered position, or once inside the building or room, the soldier progresses onto other essential tasks (i.e., room clearing). Though to the casual observer the difference between sprint and three-to-five second rush seem minimal, the differences are greater than they might appear on the surface. In a three-to-five second rush, the soldier explodes from the prone position, moves for a short

distance, then plants his feet and falls forward to prevent detection by the enemy.

Because the enemy is most likely to his front, and scanning for targets, the soldier stops after three-to-five seconds regardless if there is good cover or concealment to his front.

In an urban environment, faced with a three-dimensional threat (high, low, front, and rear), the soldier must move between covered positions. This may mean sprinting much longer distances than when conducting a three-to-five second rush. As a result, the movement is normally from a crouched position, to a sprint requiring maximal effort, to another crouching position in the vicinity of good cover or concealment.

The accomplishment of this short duration task requires moderate muscular strength and motor efficiency. Strength is a key component of speed. The soldier, while bounding from his crouch into a sprint, must have strength in his leg and hip muscles to move rapidly. Additionally, as with most combat tasks, the soldier is burden by the additional weight of his mission essential equipment. This may provide as much as thirty to forty extra pounds of weight. In order to perform this movement successfully, the body must string together several critical tasks. In so doing, it must apply a moderate amount of motor efficiency. In terms of demand, most events that require moderate-to-high demands of motor efficiency also require flexibility. This is also true of the sprint. It requires a low demand of flexibility.

As a result of the short nature of the event, endurance of any sort plays almost no role in its accomplishment. As a result, there is no demand produced as a result of muscular, aerobic, or anaerobic endurance.

High or Low Crawl

A soldier on the battlefield is expected to begin individual movement techniques once in contact with the enemy. Effective suppression from the enemy normally occurs at the direct fire range of his small arms weapons--a maximum of about 200 to 250 meters in most environments. Generally, at some distance of less than 200 to 250 meters, as an element begins to assault, it receives direct fire from the enemy. The team or squad uses various individual movement techniques to continue the assault on the enemy by fire and maneuver. When an element is maneuvering, another element should cover it with fire. As a result, the movements are interrupted by periods where the team or squad covers the movement of another element with direct fire.

The demand on the body in terms of muscular endurance is great. The body is repetitiously executing a series of pushing and pulling movements that place a great demand on the legs, arms, and shoulders. It is also a very demanding anaerobic task, as the body must execute a very high-intensity, short-duration event with submaximal effort over an extended period of time. Even at short distances, this can be demanding. At distances of one hundred meters and greater, this would be especially difficult to sustain. Lastly, this event takes a great amount of coordination, and therefore, motor efficiency. To achieve efficient strides while crawling, the legs, arms, and hands must all work together to achieve the greatest amount of displacement. This is often complicated by needed mission essential equipment that makes balancing the load while moving difficult. This includes litters, breaching kits, antitank weapons, and the soldier's assigned weapon.

In moving, the soldier must pull and push his body weight plus the additional weight of his equipment. Often this is over rolling terrain with obstacles that impede

movement. This requires strength. Additionally, flexibility allows the soldier to maximize his technique when conducting the full range of movement executed by the arms and legs.

Carry

In examining a task like carry, one begins to understand the importance of motor efficiency in the tasks that a soldier executes. Very often, calisthenics focus on the repetition of one muscle group (i.e., push-ups or sit-ups). However, carrying anything requires a great deal of tasks coming together successfully. Soldiers carry many things on the battlefield--sandbags, ammunition, but most importantly, casualties. An unconscious casualty, regardless of weight, is incredibly difficult to balance and lift, especially considering the need of the “lifter” to maintain his own balance. All these things must happen to successfully pick up the casualty, but the lifter still has a responsibility to move and evade enemy fire, while evacuating the casualty. The result is a task that requires a great amount of muscular strength, anaerobic endurance, and motor efficiency.

The need for strength is obvious. The simple task of lifting a casualty may be the most physically strenuous tasks a soldier is asked to perform. To successfully evacuate the casualty, while evading fire, requires anaerobic endurance, as the soldier bounds from positions of cover to protect himself and his casualty from direct fire. The need for motor efficiency has already been discussed. Once again, another example is presented where several tasks must be completed successfully to accomplish the mission.

Casualties must be evacuated out of direct fire from the enemy. Depending on the environment, this could be as far as one hundred meters. As a result, muscular endurance

plays a moderate role in the soldier's ability to evacuate the casualty. To be successful, the sequence of lifting, running, and seeking cover may have to be repeated five or six times. Other factors that play a part are flexibility--with a focus on bending and squatting and a low amount of aerobic endurance.

Digging

Digging is a less complex, though no less important, task than the many that have been studied thus far. In a light infantry unit, soldiers dig "hasty" positions any time that it appears that they will be stationary for even a few hours. This encompasses little more than scratching out a place to lie and establishing some cover to the soldier's front. When preparing to occupy a piece of terrain with the intent to retain it and deny its passage by the enemy, the establishment of fortifications becomes much more critical. In accomplishing this, digging takes on increased importance. The standard individual fighting position requires a hole to be to be at least armpit deep--generally at least three-to-four feet.

The primary component needed in digging is muscular endurance. Digging is characterized by repeated submaximal muscular effort that places a great demand on the biceps, abdominal muscles, shoulders, and back. Additionally, it requires a moderate amount of muscular strength, aerobic endurance, anaerobic endurance, and motor efficiency. Strength is demanded in the lifting and throwing of the dirt. Though digging looks simple, the act of digging itself stresses different parts of the body. A soldier uses his arms and abdomen to thrust the shovel into the soil, uses the back and biceps to lift the shovel from the soil, then uses the arms, back, and shoulders to throw the soil from his position.¹¹ These intermittent events, executed at a high intensity, represent an

anaerobic demand on the body. Aerobic endurance is required because the series of actions needed to dig, when conducted continuously, place a cardiovascular stress on the body.

Three-to-Five Second Rush

The three-to-five second rush is a fundamental movement technique that is employed by individuals as part of a squad or team once they begin taking direct fire from the enemy. In discussing high crawl and low crawl, certain aspects of the three-to-five second rush were discussed. The rush itself involves exploding up and forward from a prone position, performing a rush at a very high intensity toward an identified location, then planting the feet and falling forward, using the butt of the weapon to break the fall. The goal is to make significant advances toward the enemy without being up long enough to be identified and engaged. Unlike running, this event is performed intermittently, at a very high intensity, and as result, places a very great anaerobic demand and a much lesser aerobic demand on the body. Additionally, it requires great motor efficiency to be accomplished successfully. The soldier must maintain his balance carrying his mission load as he explodes from the prone, negotiates the terrain and obstacles in his path as executes his rush, then falls forward efficiently using the butt of the weapon to break the fall. To the casual observer, this might sound relatively simple. However, in actual practice, a number of factors always complicate execution. Weapons are heavy and affect balance as a soldier rises from the prone. The kevlar helmet, when not secured tightly, has a tendency to slide forward over the eyes. A concealed hole or tree stump can easily trip a soldier and cause him to fall. And lastly, failure to use the butt of the

weapon when falling forward, instead of landing on the elbows, can cause serious bodily harm.

To a moderate degree, it requires muscular strength, muscular endurance, and flexibility. Muscular strength is needed to overcome the initial resistance of rising from the prone and exploding from a flat position very efficiently into a rush. Muscular endurance is required to sustain this repetitious activity, which as stated earlier, might have to be conducted over distances up to 200 meters. Flexibility is required to maximize the efficiency of the joints in this complex motor skill.

Run

Running, as described here, is not sprinting or rushing, tasks which have already been analyzed. Running is a physically demanding task involved in react to indirect fire while dismounted and move over, through, or around obstacles. In the conduct of these tasks, running involves moving across large open areas or out of the impact area of artillery, for distances greater than 200 meters. Additionally, it requires carrying mission essential equipment and a rucksack, significantly increasing the load on the soldier.

Running, in this sense, is not a high-intensity effort. It is submaximal.. In some respects, this task is similar to foot march, although it requires less muscular and aerobic endurance because the soldier does not have to move as far, and as a result, not as long. In terms of muscular and aerobic endurance, it is assessed as a moderate demand.

Lastly, the task demonstrates a low demand for flexibility, motor efficiency, and anaerobic endurance. Flexibility and motor efficiency are closely related. Not only is this not a complex motor skill, but it does not require a wide range of motion by the joints.

A summary of the analysis, which was conducted and provided by the Army Physical Fitness School, is provided in table 13.

Table 13. Physical Task to Physical Readiness Component Matrix

| Component | Muscular Strength | Muscular Endurance | Aerobic Endurance | Anaerobic Endurance | Flexibility | Motor Efficiency |
|----------------|-------------------|--------------------|-------------------|---------------------|-------------|------------------|
| Foot March | X | XXX | XXX | X | | X |
| Climb | XXX | XX | X | XXX | XXX | XXX |
| Sprint | XX | | | | X | XX |
| High/Low Crawl | XX | XXX | X | XXX | XX | XXX |
| Carry | XXX | XX | X | XXX | XX | XXX |
| Dig | XX | XXX | XX | XX | X | XX |
| three-to-five | XX | XX | X | XXX | XX | XXX |
| Run | | XX | XX | X | X | X |
| Totals: | 15 | 17 | 11 | 16 | 12 | 18 |

XXX = High Demand
 XX = Moderate Demand
 X = Low Demand

The matrix reveals several things. First, it shows the demand of each component of physical readiness present in each task. For instance, by reading horizontally across the matrix, you can determine whether the task requires no, low, moderate, or great

demand in terms of a particular physical readiness component. Secondly, summing the columns determines the correlation between each component and the physically demanding individual tasks. Physical readiness components with a high score have a high correlation to successful completion of physically demanding tasks that support the METL. Components with a low score have a lower correlation. The analysis answers two of the secondary thesis questions: (1) What are the physically demanding tasks a light infantryman will execute on the battlefield? and (2) How much of each component of physical readiness is required to conduct the tasks most likely to be executed on the battlefield? In regards to the second question, the table shows what a light infantry physical readiness program should include. A strict definition and analysis would result in the following conclusions:

1. Twenty percent of a light infantry PT program should be spent on developing motor efficiency
2. Nineteen percent of a light infantry PT program should be spent on developing muscular endurance
3. Eighteen percent of a light infantry PT program should be spent on developing anaerobic endurance
4. Sixteen percent of a light infantry PT program should be spent on developing muscular strength
5. Thirteen percent of a light infantry PT program should be spent on developing flexibility
6. Twelve percent of light infantry PT program should be spent on developing aerobic endurance

Collecting the Survey Data

Ultimately, this thesis attempts to determine whether the physical training being conducted in light infantry units is adequately preparing soldiers for the physical demands that light infantrymen should expect on the battlefield. Essential to reaching this conclusion is collecting the data that represents what light infantry units are doing as a part of physical training. The comparison, however, is not between the actual tasks being conducted in physical training and the tasks that are likely to be performed on the battlefield. A comparison of this nature would be too restrictive and defeat the intent and defined purpose of unit physical fitness training. Additionally, it would be an incorrect assumption to say that the only way to prepare for the physically demanding tasks that soldiers perform on the battlefield is to actually execute those tasks. Rather, the comparison is between the components of physical readiness required to perform battlefield tasks and the components of physical readiness required to perform the tasks these units are conducting as part of unit physical fitness training.

To determine what components of physical readiness are required in the execution of unit physical fitness training, it must first be determined what the units are doing. The survey is the tool used to determine this information. There is enough variety in unit physical fitness training that a single survey cannot determine with certainty what any one physical training program or session looks like, but it can identify trends and help determine where a preponderance of the effort is being placed.

A survey that seeks to determine what light infantry units are doing for physical training has to limit the pool of respondents to those who have served in light infantry units or who are currently serving in light infantry units. Additionally, the Army published the current version of FM 21-20 in 1992. The FM 21-20 is the doctrinal guide for the conduct of physical fitness training and is the reference leaders use in planning and executing physical training. Though published in 1992, it took some time before all members of the U.S. Army were exposed to the manual through a formal or informal education process. As a result, the scope of the research was further limited to those who had served in light infantry units within the last six years. This ensured that those who might have been influenced by guidance in a previous version of FM 21-20 did not influence the data collected to support this research.

Three primary groups were chosen to survey. The first group is light infantry Command and General Staff College (CGSC) students. This group consists entirely of majors who might have served in light infantry units anywhere within the six-year window established. As officers, this group represents the company commanders that ran physical fitness training programs in light infantry rifle companies. There are a total of eighty-nine infantry officers in the current CGSC class. CGSC only identifies officers by branch, and an exact number who fit the criteria established could not be determined prior to issuing the survey. As a result, of the eighty-nine surveys issued, a percentage was not returned simply because the officer did not meet the criteria of having served in a light infantry assignment within the last six years.

The second group chosen consisted entirely of Combined Arms Service Staff School (CAS3) captains. Almost all of the officers in this population were recently

promoted to captain and served as platoon leaders, executive officers, and staff officers in light infantry battalions. CAS3 captains generally have had only one tactical unit assignment at this point in their career. As a result, most of the officers who completed surveys in this population came from light infantry units within the last year and served in that light infantry unit for a minimum of three years. Students from two different CAS3 classes were surveyed. Once again, the total number of infantrymen who fit the required profile could not be determined prior to issuing the survey, and surveys were issued knowing some would not be returned because of the light infantry requirement. However, the survey was issued to a total of 208 infantrymen in the two classes.

The last major group surveyed is those currently serving in light infantry units. This population was increased to include enlisted, noncommissioned, and commissioned officers. To facilitate completion of these surveys, points of contact were established in each major light infantry division or brigade, surveys were sent to those individuals with guidance concerning distribution and collection, then returned for analysis. As a result, seven different light infantry units were surveyed. In some cases, more than one point of contact was established within a major unit. Each of these units received at least fifteen surveys. In total, 190 surveys were mailed to light infantry units across the U.S. Army, to include light infantry units in both continental United States and overseas locations.

The survey itself consists of sixteen multiple-choice questions that allow surveyed individuals to choose from a selection of answers. The questions are grouped into three categories. The first category seeks to determine to what unit the individual is assigned, what guidance has been given in regard to physical fitness objectives, and what level of supervision exists within their programs. One of the specific objectives in this section is

to determine if leaders in light infantry units have established physical fitness goals and if so, how they are defined. This is extremely important. How a leader defines the goals he wants his unit to achieve will shape the composition of the tasks being executed.

The second category of questions focuses specifically on tasks conducted during unit physical fitness training and the frequency with which those tasks are conducted. A total of twenty tasks are listed, and respondents are asked to determine the frequency at which they conduct these tasks. To ensure that a common language is used, the only tasks identified in the survey are tasks addressed in FM 21-20. Additionally, respondents are asked how far (on average) they run each week and how far they foot march each month. Lastly, they are asked to rank order the emphasis placed on the components of physical readiness, then asked based on this assessment, which components are overemphasized or underemphasized in their PT programs.

The last section asks only one question, and this regards assessment of physical fitness. This question asks what tools are used to measure physical readiness, and gives the respondent an opportunity to write specifically what tools are used. Similarly to the question in the first category regarding identification of objectives, knowing the tools used to make assessments is important. Again, whether purposeful or not, the tools used to make assessments will shape the composition and focus of a unit's effort. The FM 21-20 reinforces this statement. It says, "The basic rule is that to improve performance, one must practice the particular exercise, activity, or skill he wants to improve. For example, to be good at push-ups, one must do push-ups. No other exercise will improve push-up performance as effectively."¹² As a leader or commander defines their physical fitness

objectives and associated assessments, they must understand the impact this will have on the composition of their unit's physical training.

To ensure that the survey results were both precise and reliable, a simple calculation was performed to determine the required sample size. Though a standard computation, the source used for this formula came from *Probability and Statistics for Modern Engineering* by Lawrence Lapin. By specifying the desired reliability of the data and knowing the approximate size of the total population, the calculation determines the number of surveys that must be completed to ensure the survey results are an accurate reflection of the total population. In this survey, the researcher sought to obtain a 95 percent level of confidence. With a total population of approximately 19,000, the calculation revealed that 173 surveys would have to be completed to ensure accurate representation of the data. However, the response rate was determined to be only 60 percent. A 60 percent response rate factored in two variables, those that did not return or complete the survey because they did not meet the criteria (they were not "light" infantrymen) and those that met the criteria, but for whatever reason, chose not to complete and return the survey. When the sample size is adjusted to reflect a sixty percent response rate, the required sample size increases from 173 to 287. The calculation, therefore, determines that to achieve a ninety-five percent confidence level, assuming a population of approximately 19,000 and a sixty percent response rate, a total of 287 surveys must be distributed to ensure that a minimum of 172 are returned. In support of the research, 320 surveys were issued and 219 were returned. Supporting calculations are provided in appendix B.

Findings

The survey proved to be an effective tool for seeking input and helped note some trends particularly well. Of the 390 surveys issued, 321 were returned. Some surveys, as noted earlier, were issued to CGSC and CAS3 students knowing they would not meet the necessary criteria and would therefore, not be returned. Of those surveys mailed to light infantry units, all those infantrymen who received a survey met the necessary criteria. Of the sixteen unit mailings sent out, nine were returned. In all, a total of 321 responses were provided that serve as the basis for the analysis below, exceeding the 172 required to guarantee 95 percent accuracy. A review of the survey results reveals every light infantry unit was represented, and that no unit represented more than 28 percent of the total responses. As a result, no one unit dominated the responses that were returned.

Survey results were not separated and analyzed independently. Although initially survey results were tallied and separated by respondent category (CGSC, CAS3, and active duty light infantry units), no appreciable trends developed that justified further investigation. Because the surveys were anonymous, and did not inquire about the rank of the individual completing the survey or the specific period of service in a light infantry unit, the only effective comparison would have been between light infantry units. However, even within specific active duty light infantry units, it was not unusual to see a wide range of answers to the same question. This variance reflects the huge impact that small unit leaders play in the execution of physical training, especially in the light infantry community where execution of physical training programs is largely decentralized. The results showed that small variances were as common within units as they were between units.

Of those surveyed, 93 percent (304 of 321 surveyed) said that specific physical fitness goals are defined by their commanders. Additionally, they are specific to how those fitness objectives are defined. 85 percent said that the APFT is used as a tool to define goals, 72 percent said the foot march is used as a tool, and 65 percent said the four- or five-mile standard run is used as a tool. Less than 11 percent said any other tool is used as a means of defining specific fitness objectives. Of those 11 percent that identified an “other” event used to define specific objectives, 86 percent identify the pull-up as the additional tool most often used. As a result, the survey reveals that leaders have used the following tasks or events to define fitness objectives:

1. APFT: A total of two minutes of push-ups, two minutes of sit-ups, and a two-mile run.
2. Four- or Five-Mile Standard Run: Unit run conducted in a formation at either an eight- or nine-minute per mile pace.
3. Twelve-Mile Foot March: Twelve-mile foot march, wearing LCE, rucksack, Kevlar helmet and carrying individual weapons. The standard is completion of the twelve miles in three hours or less.
4. Pull-ups and Chin-ups: Soldiers complete a specified number of pull-ups or chin-ups in an unlimited amount of time.

In determining the tasks being conducted and the frequency with which they are conducted, a few trends are overwhelming. The first trend is the emphasis placed on aerobic conditioning. When asked to rank order the emphasis their unit placed on the components of physical readiness, 91 percent of respondents listed aerobic conditioning as the component that receives the greatest emphasis. Earlier in this thesis, the analysis

of combat tasks revealed that the events requiring the greatest level of aerobic conditioning are the foot march and the run. The survey results show that unit physical training programs are placing a large emphasis on these two events. Sixty-five percent of those surveyed said they ran four to five times a week as a part of their unit physical training routine. Thirty-two percent of those surveyed said they ran three times a week. Only six total people admitted running less than three times a week. This is significant. This is even more significant, however, when factored in the impact of foot marching. Seventy-five percent of those surveyed said their unit foot marches once a week. That means that most soldiers are executing a demanding aerobic event almost daily in an average five-day week.

Not only are units running and foot marching frequently, but the survey results show they are doing so for great distances. The survey showed that 40 percent are running 13 to 16 miles, and an additional 15 percent are running 17 miles or more in an average five-day week. Once again, considering that most units are dedicating one physical training session each week to foot marching, that means these distances are being run over four days. Additionally, the survey revealed that 56 percent foot march at least 16 to 25 miles each month. Of those, an additional 27 percent are foot marching 26 miles or more in a given month.

These results have an impact beyond just showing there is great emphasis on aerobic conditioning. Unit physical training sessions are limited by time. Essentially, by investing so much time in aerobic events, units are leaving little time to do much else. The average unit spends between 60 and 90 minutes conducting morning physical training. Foot marching takes an entire physical training session in itself. The average

pace at which a unit foot marches is between 15 to 19 minutes per mile, depending on the weight of the load being carried and the distance being moved. As a result, it requires at least an hour to move 4 miles--without factoring in the additional administrative events necessary to conduct a foot march (i.e., issue weapons, inspect soldier's loads, etc.).

When considering that the standard is defined as a 12-mile foot march, unit training must work to levels that place close to the same demand on the soldier. As a result, units build towards 12 miles, but do not normally do less than six miles in any one session. The FM 21-20 is specific in regards to the guidance given concerning foot marching. It says:

Beginning distances should be between five and six miles, and the pace should be at 20 minutes per mile over flat terrain with a hard surface. Gradual increases should be made in speed, load, and distance until soldiers can do the anticipated, worst-case, mission-related scenarios without excessive difficulty or exhaustion.¹³

Six miles without a break would require at least an hour and one-half to complete. However, when foot marching in accordance with the foot march manual (FM 21-18), units are directed to take 10-minute breaks every 50 minutes.¹⁴ As a result, this further draws out an already time consuming process.

Running is also a time consuming event, regardless of the level at which it is conducted. Unit runs are executed at between eight and nine minutes per mile. Generally, as the size of the formation grows (i.e., from platoon to company or company to battalion), the pace gets slower. Most respondents reported running 13 to 16 miles or more each week. If this distance is being run over four training days, the average run length is about three and one-half miles. On average, a four-mile run is going to require at least 30 minutes to execute. In a sixty-minute physical training session, when factored in a warm-up and cool-down, only 15 minutes may remain to do other things.

Exercise must be done regularly to produce a training effect. The FM 21-20 defines this as the principle of regularity. Essentially, it says sporadic exercise may do more harm than good and that a person or unit should strive to exercise each of the components of physical readiness at least three times a week.¹⁵ In many cases, this is not happening. The survey helped show where units are not meeting this standard.

Forty-six percent of respondents report that strength training with weights is not a part of their physical training plan at all. An additional 38 percent said that strength training with weights is only a slight part of their physical training regimen. Only 36 total respondents reported that strength training is a great or moderate part of their physical training routine. Additionally, several noted on their surveys that gyms and weight rooms were placed off-limits during physical training time by their installation commander or by a leader in their chain of command.

Additionally, the surveys reveal very little regular integration of those events that enhance mobility and agility, and improve motor skills. Thirty-nine percent reveal that their unit does not do guerrilla drills at all. Of those that do, only seven admitted to doing them more frequently than monthly. The remaining responses were almost equally distributed between quarterly and semiannually, with 30 total respondents reporting execution monthly. A very similar response is given for grass drills. Thirty-five percent admit not doing them at all as a part of their unit physical fitness routine. Less than ten reveal doing them more frequently than monthly. Once again, the distribution is equal between quarterly and semiannually. Guerilla and grass drills are events that receive great emphasis in FM 21-20, and are further benefited by the fact that they do not require any resources to execute.

The obstacle course is another excellent example of an event that builds motor fitness, enhances mobility, and can exercise other components of fitness as well. FM 21-20 states that “success in combat may depend on a soldier’s ability to perform skills like those required on the obstacle course.”¹⁶ Fifty-nine percent of respondents report not executing obstacle courses at all or not doing them more frequently than semi-annually. Only 26 percent report executing the obstacle course quarterly.

A similarly negative trend is reflected in “carrying” tasks--the litter carry and fireman’s carry. The two tasks that might replicate the very physically demanding task on the battlefield of evacuating a casualty are executed so infrequently as to not be a factor in light infantry physical training programs. Only 7 percent of respondents report doing litter carries more frequently than monthly, and only 16 percent report doing fireman carries more frequently than monthly.

The association between how physical fitness objectives are defined, how they are assessed, and the actual tasks being conducted is very close. Earlier in this chapter, the tasks used to define specific fitness objectives were identified. The last section of the survey asks respondents to define how fitness is being assessed in their units. Essentially, the events used to assess fitness were the events in which the objectives were defined. As a result, 98 percent report the APFT as an assessment tool, 72 percent report using the foot march as an assessment tool, and 64 percent report using the four- or five-mile standard run as an assessment tool. Less than 12 percent offered “other” events that are used to assess soldier and unit physical readiness. Of those that did, the pull-up was the other most frequently cited. The end result is physical training programs focused on the

events by which leaders choose to define and assess them, and the surveys, once again, reflect this.

In terms of aerobic activity, this trend has been established and discussed. The two-mile run (one of three APFT events), four- or five-mile standard run, and twelve-mile foot march are events leaders used to define and assess performance, and a huge preponderance of effort has been dedicated to them. These three events are aerobic intensive events. Additionally, there is a corresponding emphasis on the other events that leaders have chosen to define and assess physical readiness--the push-up, sit-up, and pull-up.

Of those surveyed, 70 percent reported doing push-up routines at least three times a week, with another 29 percent conducting them twice a week. Only three people revealed doing push-ups less frequently than twice weekly. The 78 percent reported doing the sit-up or abdominal work-outs three times or more during the week, with the remaining 21 percent conducting them twice a week. Two people reported doing them less frequently than twice a week. Seventy-six percent reported doing the chin-up or pull-up two times or more each week. As the discussion above reveals, an emphasis on these events should not be surprising. Again, units are defining specific standards for these events and use them as a tool for assessing unit physical readiness. It is reasonable to assume that unit physical training is being focused in those areas where leaders have chosen to define and assess physical readiness.

Two other events, however, are being executed frequently though leaders have not defined a specific objective for them or use them as assessment tools. These events are the dip and the sprint. The dip is executed as frequently as the chin-up, with 67

percent of respondents reported executing the dip at least twice a week. Additionally, 91 percent of respondents report incorporating sprints into their routine at least once a week. The survey reveals, then, that the following events are being integrated regularly into unit physical training programs:

1. Foot March
2. Run
3. Sprints and Relays
4. Sit-Up
5. Push-Up
6. Chin-Up and Pull-Up
7. Dip

The tasks listed above reflect those tasks executed in unit physical training with the greatest frequency. When asked to rank order the emphasis that their unit placed on the components of physical readiness, the response was generally the same. There was a generally strong emphasis on aerobic endurance, muscular endurance, and anaerobic endurance. Similarly, there was a low emphasis on flexibility, muscular strength, and motor skills. When the rank ordering was given numeric values (1 point for a 1, 2 points for a 2, etc.), the results showed the following ordering from greatest to least emphasis:

- | | |
|------------------------|--------------|
| 1. Aerobic Endurance | 245 points |
| 2. Muscular Endurance | 478 points |
| 3. Anaerobic Endurance | 697 points |
| 4.. Flexibility | 898 points |
| 5. Muscular Strength | 978 points |
| 6. Motor Skills | 1,101 points |

Having identified the tasks being executed with the greatest frequency in unit programs, the tasks were then assessed to determine the physical components required to execute each one. This analysis is very similar to the one done in analyzing the components of physical readiness required to execute our combat tasks.

Foot March

The foot march as described here is almost identical to the foot march the soldier is expected to execute on the battlefield. Though as a part of physical training, commanders may vary the weight carried and distances moved, it still is a very useful tool in building aerobic endurance. Additionally, because in combat soldiers will carry heavy loads over long distances, the foot march is essential in developing endurance in the muscles of the lower body. Foot marches are performed with LBE, kevlar helmet, individual weapon, and rucksack.

Specifically, the foot march measures the local muscular endurance of the leg and back muscles. Additionally, because the foot march is a continuous movement requiring submaximal effort, it also measure aerobic endurance. As a result, foot marching demonstrates high demand for muscular endurance and aerobic endurance.

Lifting this load onto the soldier's back, then managing this load during movement, requires strength. It also requires motor efficiency. It is not enough that a

soldier be able to get the load onto his back, but he must also be able to move efficiently with the load. This means an ability to kneel and crouch with the load, and an ability to move over varied terrain. As a result, foot marching demonstrates low demands for motor efficiency and muscular strength.

Run

Running is an aerobically demanding event. Whether running two miles or five miles, a demand is placed on aerobic endurance and the individual’s lower body or leg muscle endurance. Additionally, especially in shorter runs like the two-mile run required on the APFT, individuals exhibit a moderate amount of anaerobic endurance. This is characterized by periods of higher intensity for short duration, often at the beginning and end of the run. For distances three miles and less, running demonstrates equal demands for aerobic and anaerobic endurance. For distances greater than three miles, this becomes almost a purely aerobic endurance event.¹⁷ Table 14, an extract from the *Master Fitness “Fit to Fight”* manual, reveals this relationship.

Table 14: Energy System Integration

| Activity | Aerobic | Anaerobic |
|-----------------|------------|------------|
| 440 yard sprint | 5 percent | 95 percent |
| 1 Mile Run | 25 percent | 75 percent |
| 2 Mile Run | 40 percent | 60 percent |
| 6 Mile Run | 80 percent | 20 percent |

Additionally, running requires low demands of flexibility and motor efficiency.

Sprint

A sprint differs from a run in that it is a short-duration event executed at a high intensity. Because it is executed over a such a short period of time, endurance plays almost no role in its accomplishment. Primarily, sprinting requires muscular strength and motor efficiency. Strength is a key component of speed. In the execution of the movement, the body must apply a moderate amount of motor efficiency. Additionally, the sprint requires a moderate demand for flexibility.

Push-Up

In doing the push-up, soldiers are preparing for the standard created by the APFT. This standard requires the soldier to do as many push-ups as possible in a two-minute time period. The push-up places great demand on the endurance of the chest, shoulder, and triceps muscle, and therefore, has a high demand for muscular endurance. The push-up is executed at high intensity for short duration, and as a result, requires a moderate amount of anaerobic endurance. Strength plays a very small role in the execution of the push-up as the task only demands pushing an amount less than the total weight of the individual.

Sit-Up

The sit-up is almost identical to the push-up, except that it places a great demand on the abdominal and hip flexor muscles. Soldiers also have the measurable standard created by the APFT in which to focus their preparation (as many repetitions as possible in a two-minute time period). As a result, the sit-up places the same demand as the push-

up in terms of muscular endurance, muscular strength, and anaerobic endurance.

Additionally, because the sit-up requires a fair amount of trunk flexion, it requires a low demand for flexibility.¹⁸

Pull-Ups

Generally, when executing pull-up or chin-ups, the exerciser performs as many repetitions as possible in an unlimited amount of time before reaching muscle failure. The pull-up and chin-up are primarily a measure of the strength of the back, shoulders, forearms, and biceps and require a moderate amount of muscular strength and endurance. Unlike the push-up, where the resistance is a sum less than the individual's body weight, the pull-up requires the individual to lift his entire body weight from a hanging position until the head rises above the hands. Anaerobic endurance is moderately involved.

Dips

When executing a dip, the individual begins with the feet off the floor and the body's weight supported on straight arms. To perform a repetition, the exerciser bends the arms until the upper arms are at least parallel to the floor, then returns to the starting position. The exerciser executes as many repetitions as possible in an unlimited amount of time. This exercise is similar to many other events studied in this section. It requires only a small amount of strength, but requires moderate amounts of muscular endurance and anaerobic endurance.

Table 15. Components to Physical Tasks Performed During Unit Physical Training

| Component | Muscular Strength | Muscular Endurance | Aerobic Endurance | Anaerobic Endurance | Flexibility | Motor Efficiency |
|-----------|-------------------|--------------------|-------------------|---------------------|-------------|------------------|
| Foot | X | XXX | XXX | X | | X |
| Run | | XX | XX | X | X | X |
| Sprint | XX | | | XX | XX | XX |
| Push-Up | X | XXX | | XX | | |
| Sit-Up | X | XXX | | XX | X | |
| Dip | XX | XX | | XX | X | |
| Pull-Up | XXX | X | | X | | X |
| Totals: | 10 | 14 | 5 | 11 | 5 | 5 |

XXX = High Demand
 XX = Moderate Demand
 X = Low Demand

This analysis reveals the amount of demand of each component of physical readiness present in each task when executed one time. The same determination was made for the combat tasks earlier in this chapter. However, with the combat tasks, the frequency with which they would be conducted was unknown. The METLs are not prioritized. As a result, the METL becomes a list of tasks that a unit should be expected to perform in combat. The frequency at which the supporting individual tasks would be executed is unknown. Unlike the combat tasks, the survey was able to determine what frequency certain events were being conducted. As a result, the physical training tasks will be weighted to reflect the number of times in a given five-day week they are executed. The value of a particular task will be the product of the weight given times the

demand for the event. Events with low demand were give a single point, moderate demand was given two points, and high demand was given three points. This information will be taken directly from the results obtained in the survey. Adding weights to the tasks to reflect the frequency with which the task is conducted will change the results obtained in the above table. With weights added, events executed more frequently will receive more points to reflect the emphasis given in unit physical training programs. The resulting table 16 reveals this.

Table 16. Components to Physical Tasks Performed During Unit Physical Training (Weighted)

| Component Tasks | Weight | Muscular Strength | Muscular Endurance | Aerobic Endurance | Anaerobic Endurance | Flexibility | Motor Efficiency |
|--------------------|--------|----------------------|-----------------------|----------------------|------------------------|-------------|---------------------|
| Foot March | 1 | X (1) | XXX (3) | XXX (3) | X (1) | | X (1) |
| Run | 4 | | XX (8) | XX (8) | X (4) | X (4) | X (4) |
| Sprint | 1 | XX (2) | | | XX (2) | XX (2) | XX (2) |
| Push-Up | 3 | X (3) | XXX (9) | | XX (6) | | |
| Sit-Up | 3 | X (3) | XXX (9) | | XX (6) | X (3) | |
| Dip | 2 | XX (4) | XX (4) | | XX (4) | X (2) | |
| Pull-Ups | 2 | XXX (6) | X (2) | | X (2) | | X (2) |
| Totals: | | 19 | 35 | 12 | 25 | 11 | 9 |

This table reflects the amount of demand of each component of physical readiness present in each task when executed over a week. The preponderance of effort is being placed in unit physical training programs as follows:

1. Thirty-two percent of the effort is dedicated to developing muscular endurance
2. Twenty-three percent of the effort is dedicated to developing anaerobic endurance
3. Seventeen percent of the effort is dedicated to developing muscular strength
4. Ten percent of the effort is dedicated to developing aerobic endurance
5. Ten percent of the effort is dedicated to developing flexibility
6. Eight percent of the effort is dedicated to developing motor efficiency

The values obtained above will now be compared to the values obtained for combat tasks. This comparison will reveal how well unit physical training tasks are contributing to the components necessary for successful completion of combat tasks. This analysis follows in table 17.

Table 17. Comparison of Combat Task to Physical Training Tasks as They Relate to the Components of Physical Readiness

| Component / Task | Combat Tasks | Physical Tng Tasks | Difference |
|---------------------|--------------|--------------------|------------|
| Muscular Strength | 16 percent | 17 percent | 1 percent |
| Muscular Endurance | 19 percent | 32 percent | 13 percent |
| Aerobic Endurance | 12 percent | 11 percent | 1 percent |
| Anaerobic Endurance | 18 percent | 23 percent | 5 percent |
| Flexibility | 13 percent | 10 percent | 3 percent |

| | | | |
|------------------|------------|-----------|------------|
| Motor Efficiency | 20 percent | 8 percent | 12 percent |
|------------------|------------|-----------|------------|

The comparison in many ways is surprising. The comparison reveals that four of the six components of physical readiness are being adequately addressed (5 percent difference or less) in unit physical training programs. Only two components of physical readiness, muscular endurance and motor efficiency, appear to be receiving a disproportionate amount of emphasis. In terms of muscular endurance, units are devoting more effort than necessary in developing this component. In regard to motor efficiency, units are not dedicating enough effort to developing this physical component.

As mentioned above, there are several surprises in this analysis. The first of these is in regard to physical strength. Eighty-four percent of respondents reported that strength training with weights is either a slight or nonexistent part of their unit physical training program. However, this does not necessarily mean that this component is being underemphasized. Rather, based on the types and frequency of tasks being conducted, the muscular strength component is being adequately addressed. Specifically, the fact that push-ups, sit-ups, dips, and pull-ups all demonstrate a demand for strength, the frequency with which they are being integrated in light infantry physical fitness programs have ensured that this component is adequately addressed. Additionally, the tasks reveal that the strength component is adequately distributed between upper and lower body. The foot march and sprint are addressing leg and hip strength, while the push-up, pull-up, and dip are focused more on upper body strength.

Equally as surprisingly, it does not appear that aerobic conditioning is being overemphasized. The survey revealed that units are developing the aerobic component through two specific events--the weekly foot march and unit runs. No other task or tasks

being performed are placing an aerobic demand on the soldier. As a result, though a great amount of emphasis is being placed on running, units are still only meeting the identified aerobic goal produced in the combat tasks analysis. Additionally, not only did the survey reveal units were running frequently, but significant distances as well.

Perception seemed to support this assessment. Of those surveyed, 33 percent (105 of 321) reported that aerobic conditioning was over-emphasized in their unit programs. No other component received more than twenty responses when questioned about overemphasis. At this point, however, it becomes necessary to separate the ends from their means. Units have chosen to use the run and foot march (means) as the only components to build aerobic endurance (end). They are doing these events with such frequency that soldiers believe the whole component is being over-emphasized. Rather, units need to look at other ways of developing aerobic fitness. In discussion with MAJ Danny McMillian, a sports physiologist at the Army Physical Fitness School, he says “repeated anaerobic events during PT will improve to some degree aerobic endurance. So, in effect, we can do a lot less distance running, use the time to work motor efficiency and strength with anaerobic tasks, and still meet our aerobic demands.”¹⁹ The options available to units are abundant, and discussed in detail in FM 21-20, they are just not being integrated.

Lastly, the comparison reflects a huge disparity in the emphasis that should be placed on motor efficiency and the actual emphasis it is receiving in unit physical training programs. The combat task to physical readiness component matrix revealed that four of the eight combat tasks require a high demand for motor efficiency. Two of the remaining four combat tasks require a moderate demand of motor efficiency. Reflecting back on

Major McGuire's discussion on movement in planes, this high demand for motor efficiency manifests itself by an abundance of tasks that are multiplanar. In analyzing unit programs, the physical training task to physical readiness component matrix revealed that only one task required even a moderate demand for motor efficiency. Additionally, those tasks being executed most frequently in our physical training occur only in one plane. As a result, units may be failing to build those "skills" in this component that are critical to success on the battlefield. Those events that build motor efficiency are discussed and emphasized in FM 21-20--guerilla and grass drills and the obstacle course are prime examples. The surveys, however, reveal that units are not executing these events with the frequency necessary to adequately develop this physical component.

The analysis and discussion thus far has answered all of our secondary questions. Critical to the analysis of unit physical training programs was simply understanding what physically demanding tasks the infantryman is expected to execute on the battlefield. In applying the principle of train as you fight, unit leaders have a responsibility to prepare soldiers for the physical demands an infantryman should expect in combat. To determine these tasks, a methodical approach, supported by doctrine, was used to break each METL down into supporting platoon collective tasks and then demanding individual tasks. The tasks foot march, climb, sprint, high/low crawl, carry, dig, three-to-five second rush, and run were determined to be those tasks most likely to be executed on the battlefield.

Having identified these tasks, they were then assessed against the components of physical readiness. This answered another secondary question by defining the components, and the amount of each component, required when executing each of the physically demanding individual tasks (combat tasks). These results would serve as the

benchmark for comparison later on once it was determined what tasks units were executing as a part of their physical fitness training. When the components are rank ordered from greatest to least demand, the result is as follows: motor efficiency, muscular endurance, anaerobic endurance, muscular strength, flexibility, and aerobic endurance. Though it remains important to maintain a balance between strength, mobility, and endurance, this shows that not all components are equal, and identifies components that should be emphasized in unit physical training programs.

To understand what tasks light infantry units were executing as a part of physical training, three select groups were surveyed. CGSC light infantryman, CAS3 light infantryman, and a combination of officers, non-commissioned officers, and enlisted soldiers currently serving in light infantry units. Over 390 surveys were distributed and 301 were returned. The surveys revealed that the following tasks were executed most frequently, and routinely, in unit programs: foot march, run, sprints, push-ups, sit-ups, pull-ups/chin-ups, and dips. This answered the third secondary question and facilitated assessment of these tasks against the components of physical readiness.

The assessment of unit physical training tasks answered the final secondary question. The assessment revealed where unit emphasis, once again in terms of physical readiness components, was being placed. From greatest to least emphasis, the result was as follows: muscular endurance, anaerobic endurance, aerobic endurance, flexibility, and motor efficiency. Essentially, this comparison revealed discrepancies between what units were doing (in terms of physical readiness components) and where there emphasis should be focused to develop those skills necessary for success in combat.

1

²Lt. Col Lawrence P. Crocker, *The Army Officer's Guide* (Harrisburg, PA: Stackpole Books, 1988), 497.

³FM 21-20, *Physical Fitness Training* (Washington, DC: Department of the Army, 30 September 1992), 3-1.

⁴*Ibid.*, 3-1.

⁵*Ibid.*, 3-1.

⁶*Ibid.*, 2-0.

⁷*Ibid.*, 2-0.

⁸*Ibid.*, 4-1.

⁹*Ibid.*, 1-3.

¹⁰Major Danny McMillian, Ph.D., e-mail correspondence with the author, Fort Leavenworth, KS, 7 March 2001.

¹¹*Ibid.*, 7 March 2001.

¹²FM 21-20, (30 September 1992), 1-4.

¹³*Ibid.*

¹⁴Department of the Army, FM 21-18, *Foot Marches* (Washington, DC: Department of the Army, 30 September 1992), 22.

¹⁵FM 21-20, (30 September 1992), 1-4.

¹⁶FM 21-20, (30 September 1992), 8-1.

¹⁷Louis F. Tomasi, Ed.D., telephone interview by author, Fort Leavenworth, KS, 6 March 2001.

¹⁸Major Danny McMillian, Ph.D., e-mail correspondence with the author, Fort Leavenworth, KS, 7 March 2001.

¹⁹*Ibid.*

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This thesis ultimately seeks to determine whether light infantry physical training programs include the necessary combat focus to adequately prepare light infantry soldiers for the rigors of combat. The analysis shows that the tasks being conducted in unit physical training are effectively addressing most of the physical readiness components. However, motor efficiency and mobility were shown to be almost non-existent in unit programs. Analysis of the light infantryman's combat tasks revealed that on the battlefield, the infantryman will execute complex tasks in more than one plane of motion that require a high degree of mobility and coordination. Unquestionably, developing mobility is essential to successful performance on the battlefield. This discrepancy, which is further exasperated by poorly defined fitness objectives and means of assessment, reveals that unit programs do not contain the combat focus necessary for success on the battlefield. Other findings resulting from analysis of the surveys include:

1. Units run too much, but they are not focusing too much on aerobic endurance. The only events being used to build aerobic endurance are running and foot marching. Other events that build aerobic endurance must be utilized.
2. Lack of weight training does not mean that unit programs are not developing muscular strength.
3. Units are very focused on those events leaders use to define their fitness objectives and assess physical fitness readiness.
4. Light infantry programs revealed surprising similarities.

The discrepancy in regard to mobility, and its impact on this thesis, deserves greater discussion. Essentially, the argument becomes whether or not soldiers can be prepared for the physical demands of combat if their physical fitness training lacks mobility and motor efficiency training. To highlight this deficiency, comparisons are drawn to a basketball player. A person can be tall, fast, have great endurance, and be able to jump high, yet still not be an effective basketball player. Despite the presence of these physical “tools”, basketball requires the execution of complex motor skills to be successful. Many of the tasks required in basketball are multi-planar. These tasks include rebounding, dribbling, shooting, defending, blocking-out, etc. Unless these specific tasks are trained, a person will not develop the skills necessary to excel on the basketball court. It is with this same mindset that military leaders must approach physical fitness training for soldiers. Ultimately, they are preparing soldiers for the complex, mobile, and fluid environment of combat. As a result, leaders must make better use of those events that build and enhance a soldier’s mobility, agility, and coordination.

The adjustment to actual physical fitness programs is minimal and can be remedied easily with leader emphasis and education. Take for instance a unit that decides to do a circuit as a part of physical training. The unit meets at the track, or in a parking lot, and along a 3 mile run route stops at designated areas to conduct push-ups, pull-ups, crunches, flutter kicks, sprints, etc. An analysis would show that a workout of this nature is improving muscular strength, aerobic and anaerobic endurance, and muscular endurance. However, mobility is almost completely ignored. All these tasks, while physically demanding, are executed in a single plane. A small adjustment shows

how effective mobility training, that is combat focused, can be integrated. Had the unit identified a cross country route and at designated stations instead chosen to conduct a vertical rope climb, low crawl, zig zag rush, saddle back carry, monkey bars, broad jumps, 3-5 second rushes and a fireman's carry, the difference in terms of developing mobility would be significant. Like the first circuit, this circuit also improves muscular endurance, aerobic and anaerobic endurance, and muscular strength. The advantage to the second circuit, however, is that it also develops mobility. Additionally, it very closely replicates many of the identified combat tasks. Without significantly changing the PT session, the unit executes a session that develops a critical component that must be addressed if soldiers are to succeed physically on the battlefield.

The survey conducted during this thesis reveals that many leaders are stating fitness objectives and assessing unit fitness primarily through the use of the APFT, 4 or 5-mile standard run, the 12-mile foot march, and pull-ups. These events, however, do nothing to measure mobility. The lack of a mobility assessment tool, combined with the fact that leaders do not appear to be emphasizing mobility as a part of PT, has resulted in mobility becoming the "lost component." The advantages of the above events as an assessment tool is that very clearly defined standards, supported by scientific research, already exist. A quick assessment can be made from the raw scores or times because these events and the associated standards of performance are part of the Army culture. However, these events do not provide an accurate assessment of potential physical performance on the battlefield. By understanding the combat tasks an infantryman will perform on the battlefield, a unit can devise a set of events that more accurately portrays a unit's physical readiness. The Army Physical Fitness School recommends some

alternate assessments. These assessments include: foot march 12 miles with a 35 lb. rucksack in less than 3 hours; perform 20' rope climb with kevlar, LCE, and weapon; complete obstacle/confidence/MOUT courses to unit time and negotiation standards; carry equal size soldier 100 meters in 90 seconds; and buddy team IMT 100 meters in 120 seconds.¹ The initial challenge would be analyzing feedback for which no historical data exists. After the first iteration, however, development of performance standards from an analysis of the initial results would be simple. The Army Physical Fitness School also makes other assessments available on their web site <<http://www.benning.army.mil/usapfs>>. These types of events, though by no means all-inclusive, would go much further in determining a unit's level of physical readiness. As reiterated throughout, this thesis does not challenge the merits of the APFT or question its validity. As long as the APFT remains a fixture of Army culture, and a requisite for any Department of the Army schools (CGSC, PLDC, BNCOC, ANCOG, etc.), it must continue to get some emphasis at unit level. It must be remembered, however, that the APFT is a three-event test that only assesses muscular endurance and cardiorespiratory fitness.² Therefore, as an indicator of readiness to execute the tasks a light infantryman must perform on the battlefield, it does not tell the leader very much. Integration of other assessments, such as the ones listed above, could occur with minimal impact on the unit physical fitness training plan and implementation of the semi-annual APFT and provide leaders a much more accurate assessment of their unit's level of physical readiness.

Another interesting conclusion drawn from the analysis is that although units are doing about the right amount of aerobic endurance training, they are running too much. This may be confusing to some because it is often assumed that aerobic conditioning and

running are one in the same. However, repeated anaerobic events during PT will improve aerobic endurance. Therefore, it is possible to do less running, but still increase your aerobic threshold.³ The analysis of combat tasks reveals that few events executed on the battlefield require a moderate or great amount of aerobic endurance. The problem is that units have chosen to build aerobic endurance through only two events--the foot march and run. Long distance running (greater than 2 miles) is not only time consuming, but as conducted, is a purely aerobic event that does next to nothing in development of motor efficiency, strength, and anaerobic endurance.⁴ Additionally, there are risks associated with physical programs that include excessive running.

There are a number of injuries associated with running. These include a prevalence of foot pain, knee pain, and shin splints.⁵ The three primary reasons for running related injuries are poor progression, too little recovery between runs, and running too hard or too long on a given run. The survey reveals that most units run four days a week and foot march once a week. The distance covered on an average run is 3.5 miles. This means the average run, when conducted at an 8 minute per mile pace, requires about 29 minutes to complete. Though not examined in this survey, research suggests that providing recovery between PT events that stress the same body parts in the same way goes a long way towards reducing injury.⁶ Clearly, the surveys reveal that as a result of the programs currently being executed, the lower extremities of light infantrymen are taking a beating. Too much running, especially in younger soldiers not conditioned to the distances or frequency with which runs are executed, can lead to higher injury rates.

The survey reveals that PT programs lack variety. Those tasks that units and leaders use as assessment tools are executed with great frequency in unit PT programs. The surveys reveal that one day a week most light infantry units will conduct a foot march. Units, on average, conduct a run on each of those remaining four days available for PT. Additionally, over the remainder of the week, units on average, do push-up workouts three times, sit-up workouts three times, dip workouts two times, pull-up workouts two times, and will do a session of sprints. Very few other events are executed with any frequency in unit programs. Though not studied in this thesis, one wonders if PT has become somewhat monotonous and boring for the average soldier.

These findings are consistent with the growing emphasis the United States Army Physical Fitness School (USAPFS) has placed on strength, mobility, and endurance. These components are the foundation for the redraft of FM 21-20. Said LTC Bill Reiger, the Commandant of the USAPFS, “the new, improved physical training will likely focus on exercises that more closely correspond with combat readiness and will de-emphasize the now rote running, push-ups, and sit-ups, which do little to help soldiers increase mobility and flexibility.”⁷ Even the recommendation of additional assessments that more accurately correspond to combat tasks and successful performance in combat is a stark departure from the doctrine units have operated under since the early 1990s. In describing how PT programs will look following implementation of the new PT manual, LTC Rieger said “something more fun, and probably more challenging.”⁸ In an experiment conducted with soldiers attending basic training at Fort Benning, PT included regular integration of dumbbells, medicine balls, and other equipment in a variety of callisthenic routines. They ran no more than 3 times per week. Even with a greater focus

on strength, mobility, and endurance, and a de-emphasis on push-ups, sit-ups, and the 2-mile run, soldiers still showed a marked improvement on their APFT scores. Of the 48 soldiers that participated in the program, 36 maxed the PT test. Not only were fewer injuries reported as a result of the program they executed, but these results seemed to confirm that soldiers can be “combat-focused” and not detract from an ability to perform well on the APFT.

One survey respondent reported in great detail the huge impact that a more combat focused approach to physical training had on his battalion. Captain Shawn Kelly, a CAS3 student who had just completed service in an infantry battalion in Korea, wrote:

Initially unit PT was focused on the APFT. 3 long runs a week; 1 road march a week with push-up, sit-up improvement mixed in. Given the harsh Korean terrain/conditions the battalion was not where it should have been. In one month we got a new command group. All three were very knowledgeable on battle focused PT. The BC (Battalion Commander) had a one page command philosophy but two page PT guidance on the first day. Through OPDs they identified that a battle focus was lacking. First we built an obstacle course around the battalion area. We purchased wood and ropes and set up wire along with some natural terrain features. We also purchased a platoon set of medicine balls and dumbbells for muscle strength and motor skills. Combatives were executed every Thursday for two hours. Emphasis was also placed on sprints and mobility drills. The end result was that the battalion APFT average went up roughly 14 points. But more importantly, on a 20-hour straight air assault defile clear we outmaneuvered the OPFOR and outlasted them. It was clear enough that both the division commander and brigade commander mentioned it. The OPFOR was another infantry battalion so they were a pretty good yardstick for comparison. To build on this, we executed PT twice a day during normal garrison operations. The second session was mobility exercises and medicine ball drills. This second session a day allowed time to round out the PT program and include flexibility training.

Unfortunately, there was little evidence of this kind of focus in other PT programs. To overcome this lack of combat focus in light infantry PT programs, and

integrate the skills necessary for physical success on the battlefield, the recommendations of this thesis are as follows:

1. Develop a light infantry specific assessment that will allow commanders the opportunity to accurately assess the physical readiness of their soldiers.
2. Educate leaders on the importance of combat focus in unit physical training programs. This would include formal education at all NCOES schools, the infantry officer basic course, infantry officers advanced course, CGSC and the Army War College. A change in programs will not be realized until leaders, especially senior leaders, are educated on the topic and understand the overall benefits.
3. Significantly increase the amount of mobility training currently included in unit programs. This would mean an increase in the frequency in which guerilla and grass drills, and obstacle courses, are integrated into unit physical training.
4. Continue to foot march once a week. The foot march will remain the basic staple of the infantryman.
5. Reduce the frequency and distances that units are running. The combat task analysis reveals that aerobic endurance has a minimal impact on the successful execution of combat tasks. Additionally, by reducing the frequency and distances being run, more time will be available to develop other physical readiness components.

History provides the necessary motivation to be physically ready. Infantryman on the battlefield will always be expected to execute physically demanding tasks and overcome hardships in defeating the enemy. This was as true in the days of the Continental Army as it was when 10th Mountain Division soldiers deployed to Mogadishu in 1993 in support of the United Nations mission in Somalia. Like a

professional athlete, being fit is simply not enough. Every aspect of training and performance must be geared toward preparing the light infantryman for the demanding, unforgiving, and fluid environment of combat. Only through dedication in training those components necessary for success on the battlefield can leaders ensure that their soldiers are “combat-ready.” Light infantry physical training is demanding and hard – even with its current deficiencies. However, to be successful, physical training must get smarter.

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¹USAPS Web Site, “Light Infantry Assessments.” Available at <http://www.benning.army.mil/usapfs/TrainingSupport/trainingsupportindex.htm>; from internet.

²Department of the Army, FM 21-20, *Physical Fitness Training* (Washington, DC: Department of the Army, 30 September 1992), 14-1

³Major Danny McMillian, Ph.D., e-mail correspondence with the author, Fort Leavenworth, KS, 7 March 2001.

⁴Ibid.

⁵USAPS Web Site, “The Right Dose of Running.” 2. Available at <http://www.benning.army.mil/usapfs/TrainingSupport/trainingsupportindex.htm>; from internet.

⁶Ibid., 2.

⁷Jane McHuch, “PT Overhaul,” *Army Times*, 28 August 2000, 14.

⁸Ibid., 15.

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APPENDIX A
SURVEY

LIGHT INFANTRY PHYSICAL FITNESS TRAINING SURVEY

The purpose of this survey is to gather information concerning the conduct of physical fitness training in light infantry units across the U.S. Army. The information gathered from this survey will be used to support an MMAS thesis being conducted by a student at the Command and General Staff College. Your answers on this survey are anonymous, and no personal information, other than unit of assignment is requested.

This survey seeks input from those who have served in a light infantry battalion within the last six years. Light infantry is broadly defined to include airborne/air assault units, but does not include the 75th Ranger Regiment. If you have served in more than one light infantry unit, please provide information from the unit with which you were most recently assigned.

Part I – General Data

1. To what light infantry unit are (were) you assigned?

- | | | | |
|---|---|---|--|
| <input type="radio"/> 101 st Abn Div | <input type="radio"/> 82 nd Abn Div | <input type="radio"/> 25 th ID | <input type="radio"/> 10 th Mtn Div |
| <input type="radio"/> 172 nd Sep Inf Bde | <input type="radio"/> 173 rd Abn Bde | <input type="radio"/> 2 nd ID | <input type="radio"/> Other |

2. Has (did) your battalion commander, company commander, or platoon leader established specific fitness objectives?

- Yes No (If no, skip to question #4)

3. How were the fitness objectives defined? (mark all that apply)

- Unit APFT Avg Foot March Std 4 or 5 Mile Std Run Other (explain below)

Other:

4. At what level is (was) most physical fitness training conducted in your unit?

- Squad Platoon Company Battalion

5. Are (were) unit physical fitness plans or schedules briefed or discussed during company and platoon training meetings?

- Yes No

Part II - Unit Programs

6. In your opinion, to what extent does (did) your fitness program enhance military skills essential to effective combat and duty performance?

Great Extent Moderate Extent Slight Extent Not At All

7. In your opinion, to what extent does (did) the APFT (push-ups, sit-ups, and 2 mile run) dominate the composition of your unit physical fitness training program?

Great Extent Moderate Extent Slight Extent Not At All

8. In an average five-day week, how many miles does (did) your unit run?

5 Miles or less 5-8 Miles 9-12 Miles 13-16 Miles 17 or more

9. In an average month, how many miles does (did) your unit foot march?

Less than 15 Miles 16-25 Miles 26-35 Miles More than 35 Miles

10. To what extent is (was) strength training with weights a regular part of your unit physical fitness training program?

Great Extent Moderate Extent Slight Extent Not At All

11. During an average week, how often does (did) your unit physical fitness routine include the following:

| | <u>1 Time</u> | <u>2 Times</u> | <u>3 Times</u> | <u>4 - 5 Times</u> | <u>Not At All</u> |
|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Run | <input type="radio"/> |
| Push-up Workout | <input type="radio"/> |
| Sit-up/Ab Workout | <input type="radio"/> |
| Chin-ups / Pull-Ups | <input type="radio"/> |
| Dips | <input type="radio"/> |
| Rope Climbing | <input type="radio"/> |
| Monkey Bars | <input type="radio"/> |
| Fartlek Tng/Sprints | <input type="radio"/> |

12. On average, how often are (were) the following events integrated into your unit physical training program:

| | <u>Weekly</u> | <u>Monthly</u> | <u>Quarterly</u> | <u>Semi-Annually</u> | <u>Not At All</u> |
|------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Foot March | <input type="radio"/> |
| Combatives | <input type="radio"/> |
| Obstacle Course | <input type="radio"/> |
| Guerilla Drills | <input type="radio"/> |
| Grass Drills | <input type="radio"/> |
| Rifle Drills | <input type="radio"/> |
| Log Drills | <input type="radio"/> |
| Litter Carries | <input type="radio"/> |
| Fireman Carries | <input checked="" type="radio"/> |
| Swimming / Pool PT | <input type="radio"/> |
| Partner Resisted Tng | <input type="radio"/> |
| Interval Tng | <input checked="" type="radio"/> |

13. How would you rank order the emphasis your unit places (placed) on the following components of physical fitness (1 = greatest priority to 6 = lowest priority)?

- Aerobic Conditioning (e.g. running) _____
- Muscular Strength (e.g. weight training) _____
- Muscular Endurance (e.g. push-ups/sit-ups) _____
- Anaerobic Endurance (e.g. sprints, interval tng) _____
- Flexibility (e.g. stretching) _____
- Motor Skills (e.g. obstacle course, grass drills) _____

14. In your opinion, are (were) any one of these components over-emphasized? (mark all that apply)

- Yes
- Aerobic Conditioning
- Muscular Strength
- Flexibility
- Muscular Endurance
- Anaerobic Endurance
- Motor Skills
- No

15. In your opinion, are (were) any of these components under-emphasized? (mark all that apply)

- Yes
- Aerobic Conditioning
- Muscular Strength
- Flexibility
- Muscular Endurance
- Anaerobic Endurance
- Motor Skills
- No

Part III - Assessments

16. What events does (did) your unit use to assess physical fitness readiness? (mark all that apply)

- APFT
- 12 Mile FM
- 4 or 5 Mile Std Run
- Other (explain below)

Other (please explain):

1

1

APPENDIX B SAMPLE SIZE DETERMINATION

DETERMINATION

of a mean:

Sample size

critical normal deviate for specified reliability $1 - \alpha$

assumed population standard deviation

$$n_p = \left[\frac{(\pi(1-\pi))}{n} \right]^{1/2}$$

desired precision (maximum error)

of a proportion:

Sample size

critical normal deviate for specified reliability $1 - \alpha$

assumed population standard deviation

desired precision (maximum error)

We're looking for this. The size of the population is assumed very large.

3% is somewhat a standard range)

Normal Distribution would approach Normality at $p = 0.5$)

proportion (π)

adjusted for correction factors (n_0)

case of the assumed population proportion (π) is likely to
you are very sure of your data, I would leave this.

Inputs

0.05
1.64
0.80

173

X% Error then divided by 2 gives a Z of ____

| | <u>a</u> | <u>Z_a</u> |
|-----|----------|----------------------|
| | 0.1 | 1.28 |
| 90% | 0.05 | 1.64 |
| 95% | 0.025 | 1.96 |
| | 0.01 | 2.33 |
| 99% | 0.005 | 2.57 |
| | 0.001 | 3.08 |
| | 0.0005 | 3.3 |

Correction Factoring:

$$n = \frac{N}{[n_0 + (N-1)]}$$

ed for Known Population Size

$n_0 = 173$
Population (N) = 19,000

111 172 111

With the numbers in the "inputs" you can say:
"We estimate that ____% of our systems are Y2K compliant, plus or minus 3%, at the 95% confidence Level."

ize - Adjusted for Response Rate

287

38 Bn
500 INF
19000

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