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A Comparison of the U.S. Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests

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THESIS

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AFIT/GEM/ENC/09-01

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Abstract

This research explores how the United States Air Force Physical Fitness Test (AFPFT) events compare to sister-services' physical fitness test events with respect to their predictability of combat capability. Multiple regression tools, non-parametric analyses, and chi^2 contingency table hypothesis testing were utilized to test hypotheses about performances and determine associations between involved variables.

AFPFT scores had minimal predictability (adj R^2 0.2045) [but improved when raw data replaced scoring sheets, pushups have no maximum, and abdominal circumference and age are removed (adj R^2 0.7703)]. Higher Body Mass Index (BMI) predicts higher combat capability (p-value 0.0208). The best two-event model incorporated a 1/2-mile run and 30-lb. dumbbell lifts (adj R^2 0.8514), and the best three-event model also incorporates pushups with no maximum (adj R^2 0.8819).

Completion of the fireman's carry has a dependency on both BMI >25 (p-value 0.00152) or a waist >32.5" (p-value 0.00521). Improvement in peer stratifications from the AFPFT to combat capability has a dependency on BMI >25 (p-value 3.19E-7), even with abdominal circumference excluded from the scoring (p-value 0.00586). Women were found to have lower combat capability than men (p-value 0.0003). Those who could not pass the fireman's carry were found to have lower combat capability (p-value 0.0002).

To my Mother,

who beat me to both my undergraduate and my Masters degree by just a few months.

Mom, thanks for always leading the way in every way.

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A COMPARISON OF THE U.S. AIR FORCE FITNESS TEST AND SISTER SERVICES' COMBAT-ORIENTED FITNESS TESTS

I. Introduction

Problem Statement

The purpose of this research is to attempt to define what physical capabilities are commonly required in combat situations, and to evaluate the ability for the United States Air Force's (USAF) current Fit-To-Fight fitness program (AFI 10-248) and its respective general fitness test to predict *combat* fitness. The current Air Force fitness test is used to evaluate service-members' *general* health. The term "combat fitness" is not well understood, as the combat role for each military service has, arguably until the War on Terror began, been significantly different and unique to each service branch. Most commonly, ground combat is associated with the Army and the Marines, and both of these services are in the process of defining what physical capabilities are necessary in combat. Both are also in the process of adapting their fitness programs to incorporate more combat skills, anaerobic exercises, and burst speed exercises. They have, or are in the process of, creating their own versions of *combat* fitness tests, which are unique from their respective general fitness test counterparts.

This research collects data on the performance measures of each event on the current Air Force general fitness test, as well as each event on the sister-service combat fitness tests. Additional collected data includes height, gender, age, weight, and a self-evaluation zero-to-ten score describing what physical fitness events other than pushups, sit-ups, and running does the subject regularly participate in. This data is used to compile multiple variable-dependent personnel stratifications from a sample population using

variations of the current Air Force test, and compares these to stratifications of the same personnel using the combinations of variables deriving from the combat fitness tests and the additional data collected. Regression, ANOVA, and contingency table hypothesis testing analysis are performed on subjects' event scores in order to determine if statistical differences or associations, if any, exist between the general health fitness test and the combat fitness tests, or if variations of the existing tests offer improved association to combat fitness. Results of these analyses determine what ramifications this research has on the Air Force and its mission.

Background

Combat of today is changing and the Air Force overseas mission is getting closer and closer to the Army and Marines role. Past wars typically involved airfields far from combat and rarely had instances of the airfield itself being attacked. Now we face common locations where our Airmen are deploying to where they are in close proximity to potential enemy forces that make them vulnerable to both direct and indirect attacks. Certain Air Force career groups are even augmenting the Army, and serving alongside them in long-term outside-the-wire deployment roles, called "In-Lieu-Of" (ILO) or Joint Expeditionary Taskings (JET). Both the Army and the Marines have questioned that a fitness program simply measuring general fitness may not be sufficient at maintaining or measuring combat readiness in their personnel. Both of these sister services are exploring additional or alternative tests to better measure *combat* fitness, or the ability to handle the stresses, strains, and sometimes urgent demands required in combat situations. The Marines have just this past year added a twice-a-year Combat Fitness Test (CFT), focusing on burst speed and anaerobic ability, which is now in its one-year trial testing

phase. Since 2002, the Army has been considering changing their current 3-part Army Physical Fitness Test (APFT) to a 6-part Army Physical Readiness Test (APRT), which includes more events to better encompass combat ability in addition to general fitness.

The Air Force is beginning to shift its thinking in terms of combat fitness as well. According to the June 9th, 2008, Air Force Times main/cover story entitled, "Fit to Fight? -- Fix the Fitness Test Now," physical training (PT) leaders in the Air Force are now starting to call for tougher tests, fairer waist measurements, *and* a combat fitness program (Hoffman, 2008). December 2008 marked the beginning of the newly incorporated "Beast" 4-day expeditionary training site within the Air Force's newly expanded 8.5 week Basic Training. Erik Holmes, staff writer for the Air Force Times, per his article from February 1st, 2009, states:

> At any given time, between 4,000 and 5,000 airmen are deployed to Iraq and Afghanistan in jobs intended to be filled by soldiers and Marines, and airmen are increasingly responsible for patrolling the areas around their expeditionary bases. 'Beast' is perhaps the most visible sign yet that the Air Force is adapting its training to the realities of fighting two counterinsurgencies that increasingly put airmen in harm's way.

The goal of this research is to collect data that when analyzed can offer statistical evidence useful in gaining insight into this new paradigm shift towards combat fitness in the United States' military. Specifically, the main objectives of this research are to determine advantages and disadvantages about the different aspects of our military fitness tests, determine what easily testable events are the strongest indicators of combat capability, and determine what variables can potentially be used by our Air Force leaders at evolving our fitness program to better meet the needs of an evolving combat mission.

Scope of the Study

The scope of this study is to physically test Air Force military personnel assigned to Wright-Patterson AFB (WPAFB) using the Marine CFT and the Army APRT, as well as receiving data from the Air Force Portal as well as the subject his/herself on their age, weight, height, self-evaluated zero-to-ten score regarding the variation in their typical workout routines, and officially recorded results of previous Air Force general fitness tests administered. This data is then statistically analyzed, although it has its own limitations in that there is a degree of accuracy to waist and height measurements, correct performance measure inputs into the Air Force Portal, the subjective counting for different test events such as the push-ups and crunches found on the Air Force's current general fitness test, the impacts of weather, temperature, and health and/or applied effort of the volunteer subjects, or the weight and/or physical fitness levels changing over time between the volunteer subjects' Air Force general fitness test and their two testing sessions on the Army PRT and the Marine CFT.

Research Question

Exploratory analysis of the different variables collected could lead to numerous implications about the Air Force's current test and/or the sister service combat fitness tests. If peer stratifications on the Air Force test as it is today end up closely relating to peer stratifications on the combat fitness tests, it can be concluded that there is a statistically significant correlation between general fitness and combat fitness, and it is likely that the Air Force current program should remain sufficient for our evolving combat mission. This outcome would also imply that our sister services may be devoting unnecessary time and resources to their new combat fitness programs. On the other side

of the spectrum, we can determine that if the peer stratifications seem to have little correlation with each other, the Air Force fitness program may be in need of a fitness test overhaul and/or the addition of combat fitness events/tests to its current fitness program in order to better keep up with the evolving combat mission. The research question then becomes, “Is the current Air Force fitness program sufficient for meeting our evolving combat roles and requirements, and if not, what easily testable fitness events or easily collectable data specific to each subject are good predictors of combat fitness which may be used to improve upon the Air Force fitness program?”

Investigative Questions

1. If someone is deemed healthy by the current Air Force physical fitness testing standards, does that necessarily deem them *combat* fit? Does very poor or very high performance on the Air Force general fitness test predict very poor or very high performance on a combat fitness test?

2. How much influence does each event within the Air Force general fitness test have on the predictability of combat fitness, and are there certain events that appear to be under or over influential? Are there better ways to weight the event scoring, or to add, subtract, or alter events in order to maximize the predictability of combat fitness?

3. Are there variable dependencies that can be found through statistical analysis that can offer strong evidence for or against certain ways of scoring future fitness tests? Are any of these dependencies common traits that may signal red flags for poor physical performance, or green flags that may signal excellent physical performances?

4. Is there a measurable difference in event performance normality of stratifications when comparing one-minute long events and two-minute long events (such as the Air Force PFT pushups versus the Marine CFT 30lbs

lifts)? What differences are evident in events with maximums and/or a minimum instead of just adjusting the scores where the top X% of the group receive the maximum score and the bottom X% receive the minimum score?

5. Does a subject's Body Mass Index (BMI) or their waist measurement per the Air Force Physical Fitness Test offer predictability towards general fitness performance and/or combat fitness performance, and is this predictability similar in either case?

Limitations

This research is limited by testing subjects and analyzing data specifically from active duty Air Force personnel at WPAFB, over the age of 18, who have medical clearance. All potential subjects must complete and pass the Air Force Health Screening Questionnaire that the Air Force currently uses prior to allowing testing on the current Air Force fitness test. Self-reporting pregnant women are excluded from the study. Subjects will take the combat fitness tests between one week (this minimum is to ensure fatigue is not a necessary variable for the analysis) and three months of each other in order to minimize physical conditioning changes as a missing variable to the study.

It is, however, a limitation in that the current Air Force general fitness test is only required to be administered once a year, and that test subjects taking the combat fitness tests a longer period of time from when they took their Air Force test may have had a significant change in their physical condition. However, it is anticipated due to in-house research support that a majority of volunteer subjects will come from the Air Force Institute of Technology's Graduate School of Engineering and Management, which are all required to complete their annual Air Force fitness tests each October. With October 2008 being at the very beginning of this research's data collection phase (October 2008 to

February 2009), this limitation is reduced significantly. Still, duration between testing dates of the different tests will likely become a required variable for a proper statistical analysis.

With the Air Force currently offering minimal formal combat fitness training to its personnel, there are three minor changes to the combat fitness tests as they were designed to what test subjects actually experience. Air Force personnel receive minimal training in the Fireman's carry, and so that portion of that particular event on the Marine CFT is done with a standard adult-weight dummy instead of actual people. The original test calls for the use of a person within ten pounds of the weight of the test subject. By utilizing dummies, however, meeting that stipulation requires an infeasible number of different-sized dummies, and so a limitation is that only one 180 pound dummy will be used, at the average weight of active duty personnel. This closely matches the mean weight of 178 pounds per a study of 592 active duty Air Force personnel by Swiderski (2005), as well as the mean weight of 181 pounds per 86 subjects tested in 2008 for this research. Secondly, the Marine CFT calls for both the lifting and the carrying of 30-pound ammunition crates, which are not commonly available in an Air Force environment. Instead, test subjects use 30-pound dumbbells in place of the ammunition crates. Additionally, typical Air Force physical fitness activities are performed in Physical Training (PT) gear, which is a specially designed light-weight uniform combined with sneakers. The combat tests were designed to be done wearing combat uniforms, such as the Air Force's Battle Dress Uniform (BDU) or the Airman's Battle Uniform (ABU). Since the Air Force is not used to physical activity in both boots and in

this type of uniform, for safety purposes the test subjects taking the combat tests are told to wear their usual PT uniforms. This is the final limitation of the study.

Chapter Summary

This research expands on the current Air Force fitness program (AFI 10-248). The goal is to specifically determine if the anthropometric measurements of the current Air Force fitness test or the sister-service combat fitness tests are good predictors of combat fitness, as defined as the physical fitness aptitude level of accomplishing typical skills required in the common combat environment. The following chapter reviews the progression of the Department of Defense's (DoD) fitness programs, the progression of the DoD's fitness tests and events, and many advantages and disadvantages of different methods for fitness training and testing used throughout the world.

II. Literature Review

Chapter Overview

This chapter reviews applicable literature to understand the fitness program as it has evolved throughout the last 100 years within the country, the military, and the Air Force. The review discusses the developments and struggles of the United States' military branches and the nation as a whole in obtaining more physically fit people and increasing fitness awareness. This review also looks at a number of studies that evaluate how fitness testing and training as well as fatigue can affect the ability to carry out sustained military operational tasks, and how different fitness tests and training programs have affected injury rates and changes in fitness levels for the Air Force and other military services. This chapter concludes with an evaluation of different physical fitness tests, including work/job-specific or combat task-specific tests.

A Century of the Changing Level of Fitness, and Fitness Awareness, in America

At the turn of this century, President Theodore Roosevelt (serving 1901-1909) encouraged living a strenuous and fitness-oriented lifestyle, likely due to his childhood battle with asthma which he overcame with a constant and rigorous exercise routine (Karolides, 1993). However, his presidential leadership and fitness awareness did not necessarily translate to his nation's military members, or those civilians drafted into military service, to being physically fit. Shortly after President Roosevelt's terms in office, World War I (WWI) began; and throughout the war, one-third of draftees were labeled "unfit" for combat and many were even "highly unfit" prior to military training (Whest, 1995; Barrow, 1988).

These implications of poor fitness levels led to national and local funding to improve public school physical education programs. These improvements, however, were short lived due to the fiscal drain of the Great Depression which began in October 1929 (Welch, 1996; Rice, 1958). Again, following World War II (WWII), reports emerged that showed that nearly half of all draftees were rejected or given non-combat positions: about 900,000 of 2,000,000 were rejected for mental and/or physical defects, of which 90% were preventable (Rice, 1958). The Special Forces even had difficulty filling their ranks with those considered vigorous, alert, or strong enough for their roles (Williams, 1948:25). Following WWII, on September 18, 1947, the United States Army Air Corps officially evolved into the United States Air Force (USAF), earning itself its own identity as a separate military service. Upon the USAF entering its first war as its own service, it too faced similar fitness roadblocks. During the Korean War (1950-1953), still nearly 50% of USAF service members failed the Air Force fitness tests (Department of the Air Force, 1961:5).

During this time period, ongoing research in the fitness field by Kraus and Hirschland utilized the six Kraus-Weber tests designed to measure strength and flexibility of trunk and leg muscles (Kraus, 1954). These six tests included:

1) With feet held on the ground by the examiner, the subject lies flat on his/her back with their hands behind the neck and performs one sit-up.
2) The subject performs one sit-up from the same position except that knees are bent with ankles close to the buttocks.
3) From the same position as tests one and two, the subject lifts his/her legs 10 inches off the floor and holds for 10 seconds.

4) The subject lies on his/her stomach with a pillow under their lower abdomen and groin and lifts their head, shoulders, and chest off the floor and holds for 10 seconds while the examiner holds their feet down.
5) In the same position as test four, the subject lifts their legs off floor and holds for 10 seconds while the examiner holds their chest down.
6) While the examiner holds the subject's knees straight, the subject stands erect, barefooted, and with feet together, and then bends over slowly and touches the floor with their fingertips and holds that position for 3 seconds.

These Kraus-Hirschland's experiments were entitled "minimum muscular fitness tests in children" and they showed nearly 60% of American children failed at least one of the Kraus-Webber tests (Kraus, 1954). President Dwight D. Eisenhower (served 1953 to 1961) was astounded by these results, and so he held a White House Conference in June of 1956 which resulted in the creation of the President's Council on Youth Fitness (PCYF) and the President's Citizen's Advisory Committee on the Fitness of American Youth (PCACFAY) (Nieman, 1990). During President Eisenhower's terms, additional health and fitness-related organizations were founded across America such as the American Health Association (AHA); American Medical Association (AMA); American Association for Physical Education, Recreation, and Dance (AAPHERD); and American College of Sports Medicine (ACSM).

Following President Eisenhower's terms in office, President John Fitzgerald Kennedy (serving 1961-1963) also had a strong commitment to fitness until his assassination in 1963, as he was quoted saying, "Physical fitness is the basis for all other forms of excellence." President Kennedy also expanded the President's Council on

Youth Fitness (PCYF) to become the President's Council on Physical Fitness (PCPF), and even wrote articles for Sports Illustrated called "The Soft American" (Kennedy, 1960) and "The Vigor We Need" (Kennedy, 1962), pointing out that Americans must become more active and put more effort into physical fitness.

A prominent figure in the history of fitness and fitness awareness, who likely encouraged more Americans to exercise than any other individual in American history, emerged during the presidency of Lyndon B. Johnson (served 1963-1969) (Swiderski, 2005). This was Dr. Kenneth Cooper, whom led a philosophy change in our country from disease treatment to disease prevention. He released a book, *Aerobics* (1968), stating, "It is easier to maintain good health through proper exercise, diet, and emotional balance than to regain it once it is lost" (Cooper, 1968:36). Cooper's ideas about endurance and oxygen utilization helped establish many of the fitness models of today (Swiderski, 2005:8).

In February 1980, President Jimmy Carter (served 1977-1981) requested the Secretary of Defense provide him an assessment of the services' physical fitness programs. This request led to a Department of Defense (DoD) symposium on military fitness in June 1980. The symposium reviewed existing fitness policies and programs, and resulted in a revised DoD Directive 1308.1: Physical Fitness and Weight Control (Destadio, 1991). With the exception of minor updates released in July 1995 and again in June 2004, this June 1981 update to DoD Directive 1308.1 was the last significant update to the United States military's overarching fitness directive. A related directive, DoD Directive 1010.10: Defense Health Promotion, was released in June 1986 and updated in August 2003. A DoD instruction falling under DoD Directive 1308.1 was DoD

Instruction 1308.3: DoD Physical Fitness and Body Fat Programs Procedures, which was released in August 1995 and updated in November 2002. These are the most current fitness related instructions and directives that are in use at the time of this writing.

Timeline of Fitness in the Air Force

(Partially paraphrased from an excerpt by Swiderski, 2005.)

1947-1959: The Air Force Regulation (AFR) 50-5 (Department of the Air Force, 1947:1) was published in November 1947 and was only three paragraphs long. It said that all Air Force programs were designed to: develop and maintain high levels of fitness in the individual, allow the individual to perform more efficiently in his/her duties, encourage regular/healthful exercise, foster an aggressive and cooperative team spirit, increase individual confidence, develop sportsmanship, and increase pride throughout participation in competitive athletics. Balke and Ware did a study in 1959 of 500 male military and civilian Air Force personnel and concluded that the Air Force's physical fitness was "poor" and that the fitness program as it stands is "ineffective" (Balke, 1959:9).

1959-1961: The Balke and Ware study prompted a revision to AFR 50-5 (Department of the Air Force, 1959: 1-10). It required commander's (CCs) to establish physical conditioning programs, establish weight limits, and prescribe regular weekly exercise.

1961-1962: The Air Force Manual (AFM) 160-26, Physical Conditioning, was published to give CCs more guidance on how to establish their physical fitness programs so that they were able to maximize their Airmen's physical, psychological, and social

fitness, which in turn would allow them to maximize their contributions to the Air Force mission (Department of the Air Force, 1961:13).

1962-1965: The Air Force adopted a model program from the Royal Canadian Air Force, which appeared more successful than its current program. This was the Five Basic Exercises (5BX) program as designed by Bill Orban in the late 1950's. This became the official Air Force conditioning program and was published as the Air Force Pamphlet (AFP) 50-5-1 for men, and was modified to ten exercises and made into the AFP 50-5-2 for women, called the XBX. The 5BX program included exercises that improved flexibility and mobility, various strength exercises of major muscle groups, and heart and lung improvement by running in place. The XBX included four exercises that targeted mobility and flexibility, the fifth worked the abdominals and the front of the thighs, the sixth worked the back, the buttocks, and the back of the thighs, the seventh worked the sides of the thighs, the eighth worked arms, shoulders, chest, back, and abdomen, the ninth worked the hips and sides and increased waist flexibility, and the tenth targeted the heart and lungs and strengthened the legs. The events of these programs were organized by grade (increasing grade coincided with increased exercise repetitions within the allotted time) within one of several charts, which modified the events slightly as the chart difficulty increased. The 5BX and the XBX programs were very simple and fast exercises requiring no complicated equipment – the 5BX was directed to be accomplished in just eleven minutes and the XBX was directed to be accomplished in just twelve minutes, both three times per week (The Royal Canadian Air Force, 1962:4).

1965-1969: A revised 5BX program incorporated several recommendations from a 1963 study group from Indiana University who met with Air Force representatives

regarding the progress of the 5BX program. The group determined that there was a lack of emphasis on physical activity, an excessive failure rate, unsatisfactory testing, and therefore recommended to remove or alter several of the exercises as well as lower the physical standards of each age group (Air Force Military Personnel Center, 1963:1-4).

1969-1971: Throughout the late 1960's, Dr. Kenneth H. Cooper, an Air Force flight surgeon, started conducting extensive tests of volunteers on treadmills to determine that human endurance capacity is closely correlated with the body's ability to consume oxygen (Cooper, 1968:47). Cooper felt that oxygen processing relating to body weight could be a good measurement of physical fitness, and after presenting his aerobics findings to the Air Force Chief of Staff, joined the team to draft the USAF Aerobics Physical Fitness Program, deemed AFP 50-56 (Cooper, 1967:2-25). This program was implemented in November 1969, and required semi-annual testing of a 1.5-mile run for time where Airmen would be placed into one of five performance categories, ranging from I (very poor) to V (excellent).

1971-1972: The Air Force published Air Force Manual (AFM) 50-15, Change 3, Physical Fitness. This established the middle category III (fair) of AFP 50-56 as the passing cut-off level, and anyone in categories I or II entered into a remedial conditioning program (Department of the Air Force, 1971:6).

1972-1978: The Air Force replaced AFM 50-15 with Air Force Regulation (AFR) 50-49, USAF Physical Fitness and Weight Control Program. The regulation renamed the five AFP 50-56 categories, moved the passing cut-off level to category II instead of III, allowed testing to be annual instead of semi-annual, and exempted Airmen over age 45

from testing. Most notably, the AFR 50-49 established minimum, ideal, and maximum allowable weights for Airmen based on age and height.

Interestingly, in May 1973, likely from these changes which made the fitness testing less strenuous, the Air Force Surgeon General's office reported a large number of reporting members were overweight and had respiratory problems. This prompted leadership to remind commanders of their responsibility of the weight and fitness of the members of their command (Susi, 1974:12). CC's made their reminders but there were no policy changes. In 1977, the AFR 50-49 was changed to AFR 35-11, Air Force Physical Fitness Program, although the changes were limited to just minor wording edits.

1978-1979: An Air Force fitness program study group in 1978 concluded that "the Air Force does not have a viable program" (Bennington, 1978:12). Their recommendations for an unsupervised conditioning program during off-duty hours as well as an annual test for all members were incorporated (removing the exemption for Airmen over 45 years old).

1979-1981: In 1979 the Air Force Surgeon General concluded that the 4-5 fatalities per year during the run test were unacceptable and so changes were made to the AFR 35-11 to allow personnel over the age of 35 to do a 3-mile-walk instead of the 1.5-mile-run. This change was not popular by younger personnel and by 1980 all personnel regardless of age could choose to do the 3-mile-walk or the 1.5-mile-run (Swiderski, 2005:15).

1981-1992: In 1981, the AFR 35-11 was again altered to also include an option for running on a treadmill if preferred over a running track, if selecting the run instead of the walk. From then until 1992, the AFR 35-11 remained the same with the only

exception being that in October 1989 the Air Force made the standards for the run time slightly more difficult.

1992-2004: The Air Force finally concluded that overexertion on the run was not only leading to several deaths per year, but was not necessarily an accurate measure of overall fitness. In October 1992 they began annual cycle ergometry and body weight testing based on two new Air Force Instructions (AFIs), AFI 40-501, The Air Force Physical Fitness Program, and AFI 40-502, The Weight and Body Fat Management Program. The cycle ergometry test was designed to estimate the point of someone's maximal oxygen uptake, or VO2 max (Mitchell and Blomquist, 1971:1018). In humans, workload increases will drive increases in oxygen uptake up until a point where the oxygen uptake reaches a maximum (Hunn, 2001:5). Since aerobic fitness is how well the body intakes and utilizes oxygen, this VO2 maximum is an excellent measure of aerobic fitness.

The most common protocol in the United States for getting a VO2 maximum, commonly just called VO2 max, is through the Bruce protocol (Jackson and Ross, 1996:267), which uses a treadmill that will stop at participant exhaustion, then inputs the total treadmill time and a measure of the participant's cardiac health into a regression formula to get a final VO2 max value. Unfortunately for the Air Force, traditional VO2 max tests such as the Bruce protocol require a lot of time, the presence of medical personnel, and a lot of money (Smith and Flatten, 1997). In order to reduce risks, manpower, time, and costs, sub-maximal cycle ergometry testing (SCET) was designed to estimate this VO2 max value within 10-20% (Pollock, 1994:20). The Air Force

incorporated this SCET and used the estimated VO2 max as an aerobic fitness measurement until 2004.

2004-2006: In 2001, a study about anxiety by Hunn, Lapuma, and Holt in 2001 may have found a problem with the SCET testing. Since the SCET test can be physiologically nerve-wracking to some people, and nervousness leads to higher heart-rates, it was found that self-reported anxiety due to the testing explained 24% of the variance of the SCET score results (Hunn et al., 2002). This may be one of the major reasons why in 2004 the Air Force replaced the cycle ergometry test with a "back to the basics" approach, which was outlined in a new AFI 10-248. This decision was lead by the Air Force Chief of Staff, General John P. Jumper, when he quoted, "The amount of energy we devote to our fitness program is not consistent with the growing demand of our warrior culture. It's time to change that" (Callender, 2004:70). This new "warrior culture" was a focus for the leadership, and the "Fit to Fight" program was initiated to bring renewed emphasis to the Air Force fitness program. Additionally, the AFI 10-248 included the directions for a fitness test which included "more standard" push-ups, sit-ups, a 1.5-mile-run, and a waist measurement.

2006-present: The "Fit to Fight" program is still in effect and is a coined phrase throughout the new "warrior culture" Air Force, and the AFI 10-248 is still the fitness program instruction. However, in July 2005, Air Force officials approved a change to the fitness testing scoring to more accurately assess certain individuals, which resulted in an updated AFI 10-248 in July 2006. Since the Air Force does annual weigh-ins and height measurements along with the fitness testing (although not for any part of the composite score), it is possible to calculate an Airman's Body Mass Index (BMI). BMI is calculated

by dividing weight in pounds by height in inches squared, and multiplying the result by 703. According to the Centers for Disease Control and Prevention, those with a BMI between 18.5 and 24.9 are considered to be normal. Those with a BMI of 25 or above are considered overweight. For this reason, the Air Force decided that any Airmen with a BMI under 25 would automatically get all 30 points for the waist-circumference portion of the test, regardless of their actual waist circumference. Those with BMI over 25 would use the normal waist circumference scoring charts (out of 30 points) from the previous version of the AFI 10-248. The remaining 70 points for the test were broken down as follows: 10 for push-ups, 10 for sit-ups, and 50 for the 1.5-mile-run. At the time of this writing, the Air Force is presently using this test.

Why Fitness Tests are Important to Consider

With many business initiatives such as Air Force Smart Operations for the 21st Century (AFSO21), Lean, Six-Sigma, Balanced Scorecard, etc., becoming the standard for the corporate and DoD worlds alike, these agencies are in essence trying to accomplish more with less (Terry, 2009). They seek efficiency and proficiency. Often the struggle in selecting the best fitness test for recruitment and retention has dire consequences on this efficiency and proficiency. If the test is too difficult, there will be too few remaining to accomplish the mission successfully. If the test is too easy, there will be too many less capable people retained within the organization, thus harming efficiency and proficiency, and perhaps increasing future medical costs for taxpayers. If the test is focused on general fitness, it is likely to better control the future medical costs as well as the overall professional appearance of the agency, but the test's effect on efficiency and proficiency of job-specific tasks is unknown. If the test is focused on job-

specific tasks, it is likely to ensure efficiency and proficiency, but the test's effect on retaining professional appearance standards or future medical costs is unknown. Due to the myriad of different fitness tests being utilized among services and agencies ranging from our Air Force to our police force and firemen today, and the myriad of different tests that have already been used but have since been replaced by them, it is evident that there has been a struggle to determine the best physical fitness selection and retention tests to use on each agency's members.

The first side of the argument for a general fitness test stems from the ease and straightforwardness of testing people on their general fitness, because it is easy to assume that those in the best physical shape would not only be the most physically capable to carry out physical tasks, but would most likely require the least amount of future medical care. This opinion is evident in numerous research experiments (Bowne et al., 1984; Baun et al., 1986; Pronk et al., 1999). The conclusion to one of these studies was that "effective, proactive population-based health improvement efforts appear to have significant potential for positive economic impact" (Pronk et al., 1999:1535). In the cases of national, state, or local government run agencies such as our military, police force, and fire departments, the simplicity and the long-term positive economic impacts are enough to satisfy most policy makers into selection of a general fitness test for recruitment and retention purposes.

In 2004, Pronk et al. suggested through further research that 1) higher levels of physical activity were related to reduced decrements in quality of work performed, as well as overall job performance; 2) higher cardio-respiratory fitness was related to reduced decrements in quantity of work performed, as well as a reduction in extra effort

exerted to perform the work; 3) obesity was related to more difficulty in getting along with coworkers; and 4) severe obesity was related to a higher number of work-loss days. Their conclusion was that lifestyle-related modifiable health risk factors significantly impact employee work performance (Pronk et al., 2004). Although physical activity can be found in both job/work-related testing as well as general fitness testing, the other conclusive variables used by Pronk et al. (2004), cardio-respiratory fitness and obesity, seem to be more supportive of general fitness testing versus job/work-task specific testing.

The other side of the argument is that someone in good physical shape may not be the best at carrying out specific job or work related tasks, even if they are physically demanding tasks. Those supporting this view of the argument worry that the person in poor physical shape that is exemplary at his or her job duties may not be selected or retained. Likewise, they fear that the person in excellent physical shape that has little coordination or little capability to carry out work-related tasks may still be selected and/or retained. King et al. (1998) conducted a critical analysis of Functional Capacity Examinations (FCE), which are chosen by organizations to define an individual’s functional abilities or limitations in the context of work tasks. King et al. (1998) found that although many FCEs included physical examinations such as musculoskeletal evaluations (similar to a fitness test for a military member), one organizational approach was to only include the musculoskeletal evaluation in the FCE if a “red flag” such as high blood pressure, elevated heart rate, or recent surgery were present. This approach suggests an opinion that military members should take FCEs specific to their work tasks and not necessarily include general fitness unless a red flag is present. This would ensure

that military members are capable of their job skills first, and that only those who need a follow-up are physically required to include some sort of musculoskeletal evaluation such as a general fitness test.

If a necessary job/work skill requires carrying heavy items, which is likely for most military personnel in combat situations as well as many in non-combat situations, then a study by Bilzon et al. (2001) becomes relevant to this side of the argument. These researchers have shown that simple field tests of aerobic fitness are not good predictors of load-carrying performance and that personnel with greater body mass are more able to perform occupationally relevant load-carrying tasks (Bilzon et al., 2001). These researchers felt that fitness tests that determine aerobic power in units relative to body mass (such as a timed distance run) incur a systematic bias against heavier personnel, and are therefore inappropriate when predicting the ability of personnel to work in occupations that encompass load-carrying tasks (Bilzon et al., 2001). As military members do work in occupations that encompass load-carrying tasks, it is implied that Bilzon et al. (2001) would be against a general fitness test that includes a timed run versus a test that actually tested individuals' abilities to carry loads such as in their duty descriptions.

There is currently little research available to determine whether or not tests that verify job or work related task capability can be linked to general fitness capability. Therefore, other than for fiscal reasons or to uphold strong professional appearance standards reasons, it is unknown whether the agencies that choose the route of general fitness requirements are potentially limiting their agency's ability to carry out work

functions, or if agencies that choose the route of job/work task specific requirements (or FCEs) are potentially limiting their agency's ability to remain physically fit.

Fitness testing as far as military personnel are concerned is specifically left up to the individual services to decide upon. DoD Directive 1308.1 guidance encompasses all military services in the United States. It is a collection of guidance designed to simply keep fitness levels "up" in military, and it provides a baseline for fitness awareness. This guidance states, "Service members must possess stamina and strength to perform, successfully, any potential mission." The guidance also states, "…each service develop a quality fitness program that improves readiness and increases *combat* effectiveness of their personnel." This directive clearly implies the desire for service members to succeed at any missions they may face, and promotes strong readiness and *combat* effectiveness. It is plausible that by achieving a high standard of general fitness you will achieve these desired goals. But of all of our services, only the Marines currently test on mission (job or work related) physical tasks in a separate test (which was just added in 2008) from their standard general fitness test (Tilghman, 2008). The Army has been considering a more comprehensive test to include more job/work related testable events since 2002, but has not approved a test change or addition as of this writing (Department of the Army, 2002). The Air Force and Navy only have a general fitness test (Department of the Air Force, 2006; Department of the Navy, 1998).

Current Fitness Programs in the United States Military

The Army Physical Fitness program is described in Field Manual (FM) 21-20, Physical Fitness Training (1998). This manual covers everything from leadership, techniques, nutrition, environment, unit requirements, and training. The Army develops

Master Fitness Trainers through 2 or 4-week training courses (MFTCs). The basis of the doctrine is the Army Physical Fitness Test (APFT) to be taken twice a year by all Army members, which includes a weigh-in, pushups, sit-ups, and a two-mile run. As with general fitness tests, it was designed to ensure a base level of physical fitness essential for every soldier in the Army, regardless of career field, known as a military occupational specialty (MOS), or duty assignment. One of the advantages of the current APFT is that it is easy to administer.

Unfortunately, the APFT has formed the foundation of many unit and/or individual training programs, leading to unit workouts that simply focus on the physical skills necessary to excel at the APFT versus excelling at skills necessary for career field tasks or combat-necessary tasks. Draft Field Manual (FM) 3-25.20 (2002) proposed to alter the AFPT to the Army Physical Readiness Test (APRT), under the belief that more assessments (events) are required due to a broad range of physical attributes being necessary for optimal soldier performance. To further strengthen the validity of the APRT, the assessments must be designed to either predict the ability to perform critical soldier tasks or closely simulate the actual tasks. The proposed APRT has more events -- to include long jump, power squat, heel-hook, shuttle run, pushups, and one-mile-run -- focusing on strength, endurance, and mobility as needed for critical soldier tasks. To succeed at these tests, FM 21-20 requires unit commanders to lead fitness training vigorously three to five times a week (Department of the Army, 1998, 2002).

The Navy Physical Fitness program is outlined in Navy Instruction 6110.1E (1998). This is very similar to the Army FM 21-20 in terms of contents. It also requires a minimum of three workouts a week, although it stipulates that these workouts should be

aerobic, and be at least 40 minutes long, including up to 20 minutes for proper warm-up and cool-down. The Navy fitness test, also to be conducted twice a year, has a weigh-in, a sit-and-reach flexibility test, sit-ups, pushups, and either a 1.5-mile-run or a 500 yard swim (Department of the Navy, 1998).

The Marine Physical Fitness program is described by Marine Corps Order 6100.3J: Physical Fitness (1988) and Marine Corps Order 6100.B: Weight Control and Personal Appearance (1993). Again, these orders are very similar to the sister-service programs, but mandates three exercise periods a week for a total of at least three hours per week. The only fitness test requirement for Marines up until 2008 was a twice a year general fitness test for all Marines under the age of 46, which consisted of pull-ups (males) or flex-arm hang (females), sit-ups, and a run (3-miles for males, 1.5-miles for females) (United States Marine Corps, 1988). On August 11th, 2008, the Marines approved a second test called the Combat Fitness Test (CFT), which is more focused on broader, real-life combat-necessary skills, mainly looking at burst speed and anaerobic ability (Tilghman, 2008). The CFT began a one-year "phase-in" period on October 1st, 2008. The Marine's original test coupled with the new CFT, twice a year, will be "a better measure of overall fitness, to better prepare the Marines for combat" (Armellino, 2008). The CFT has three events: maneuver to contact (MTC), which is an 880-yard sprint; the ammo-can lift (AL), which is two minutes of repeatedly overhead lifting a 30-lb ammo crate; and the maneuver-under-fire drill (MANUF), which is a complicated 300 yard obstacle course involving sprinting, zigzagging between obstacles, low crawling, underarm and fireman's carries, a grenade throw, and ammo-crate carries (Powers, 2008).

The Air Force Physical Fitness program, documented in the Air Force Instruction (AFI) 10-248 (2006), is also similar to the sister-services instructions and mandates duty time be allotted for up to 90 minutes for group physical training (PT) during three days each week. The fitness test, recently changed on January 1st, 2004, from an aerobic ergometric test to a general fitness test as part of the Air Force's Fit-To-Fight program, consists of sit-ups, pushups, a waist circumference measurement, and a 1.5 mile run. The scores from each section make up a composite score for overall fitness, or "health, fitness, and readiness level" according to AFI 10-248. Eighteen months into the Fit-To-Fight program, however, more updates were approved to improve the program. The major change was that Body Mass Index (BMI) was computed for each Airman (subject's weight in pounds multiplied by 703, and that value divided by subject's height in inches squared) and if under 25, the waist circumference was not used for scoring and all 30 points were given for that portion of the composite. This was in line with research that argued for utilizing waist versus height measurements, similar to BMI, since they were found to be a better measure of health/fitness than waist alone (Swiderski, 2005).

The military faces an additional complication which is the balancing act between appearance and strength. One purpose for instituting requirements for physical fitness by the DoD is to ensure an optimum body composition (within body fat standards) and this professional (physical) appearance for all military personnel. Optimum physical fitness for readiness, and for the performance of the more strenuous job classifications that have been opened to women, requires maintenance of significant strength, endurance, and muscle mass (United States Institute of Medicine, 1998). Unfortunately, optimum appearance may require a low body weight, with an associated low fat mass, which may

be accompanied by diminished muscle mass (United States Institute of Medicine, 1998). Thus in some cases, proper job readiness and physical appearance may be incompatible.

Different military services categorize their specific occupational classifications (OCC) into different strength categories, as can be seen in Table 1. According to the source of Table 1 (Food and Nutrition Board, 1998), as of 1996, the Army defines "Very Heavy" as the ability to lift on an occasional basis over 100 pounds with frequent or constant lifting in excess of 50 pounds, which corresponds to the Navy's high/high and the Air Force's high strength requirements. The Army defines "Heavy" as the ability to lift on an occasional basis a maximum of 100 pounds with frequent or constant lifting of 50 pounds, which corresponds to the Navy's high/moderate strength requirements. The Army defines "Moderate" as the ability to lift on an occasional basis a maximum of 80 pounds with frequent or constant lifting of 40 pounds, which corresponds to the Navy's moderate/moderate strength requirements. The Army defines "Medium" as the ability to lift on an occasional basis a maximum of 50 pounds with frequent or constant lifting in excess of 25 pounds, which corresponds to the Navy's moderate/low and the Air Force's moderate strength requirements. The Army defines "Light" as the ability to lift on an occasional basis a maximum of 20 pounds with frequent or constant lifting of 10 pounds, which corresponds to the Navy's low/moderate and the Air Force's low strength requirements.

Table 1. Percent of OCC's in Strength Categories for Three Services

Percent of OCC’s in Particular Category	Army	Navy	Air Force
Very Heavy	41.4%	23.9%	5.7%
Heavy	14.8%	20.9%	n/a
Moderate	22.2%	9.0%	11.4%
Medium	16.0%	4.5%	27.8%
Light	5.6%	41.7%	55.1%

Table 1 Sources: *Army*: Adapted from Sharp et al. (1980) and MAJ Kurt Berry (US Total Army Personnel Command, Alexandria, Va.); *Navy*: Adapted from DoD 132.1-1 (1995) by LT Leslie Cox (Bureau of Naval Personnel [BUPERS], Washington, D.C.) and Ross Vickers (Naval Health Research Center, San Diego, Calif.); *Air Force*: Adapted from Air Force Specialty Code, including Air Force Manual 36-2108 (1994), attachment 39, by Maj Joanne M. Spahn (Nutritional Medicine Service, 3rd Medical Group/SGSD, Elmendorf AFB, Alaska).

Per data in Table 1, the Army and the Navy (especially the Army) have a higher percentage of jobs that require significantly more strength than the Air Force does. This has strong implications for fitness test events and/or the relative weight of the scoring of strength assessment events on these tests. This also has implications on any service considering adding or converting to a job/work-specific fitness test, considering the balancing act between strength and appearance requirements. Due to their less heavy lifting requirements, the Air Force may place less emphasis on strength when compared to these sister-services. However, with the possibility of all military members being put in *combat* situations, one’s primary OCC may not be what one is required to do. For example, a service-member with an OCC in the Light category could be the sole non-wounded in an ambush on a vehicle, forcing this person to suddenly be required to carry wounded personnel to safety, who would more than likely require significantly more strength than their OCC classification category. The fact is that all services have equivalent responsibilities when *combat* forces non-OCC roles into their jobs.

The General Fitness Test, the Combat Fitness Test, or a Hybrid?

In 1995, the Australian Army made changes to its physical fitness program, with most changes better simulating combat requirements versus their status quo. These changes included changing their road runs into 400- to 800-meter (m) interval training, reducing their test run distance from 5- to 2.4-kilometer (km), and standardizing route marches. An additional change that was not combat-environment related was the introduction of deep-water running. The annual rate of male medical discharges decreased 40.8% in the year following the changes, while female rates increased 58.3%. Since there is a much larger male population to female population in the Australian Army, and not all fitness injuries result in medical discharges, these physical fitness program changes resulted in an overall reduction of 46.6% in the rate of total injury presentation (Rudzki and Cunningham, 1996). This appears to be an excellent result, although the disparity between male and female injury rates is a concern. This again has implications for having certain OCCs (typically, the OCCs requiring higher strength) be restricted to men in order to minimize injuries, and further may imply the benefits of having gender-specific physical fitness programs.

Similar injury-reducing effects took place in the United States Army's Basic Combat Training (BCT) when the existing physical fitness program was replaced with the physical readiness training (PRT), as described in the Draft FM 3-25.20 (2002), according to two studies by both the United States (US) Army Center for Health Promotion and Preventive Medicine (Aberdeen Proving Ground, MD) and the US Army Physical Fitness School (Fort Benning, GA). The first study was by Knapik, Hauret, Arnold, Canham-Chervak, Mansfield, Hoedebecke, and McMillian (2003), and the

second study was by Knapik, Darakjy, Scott, Hauret, Canada, Marin, Rieger, and Jones (2005). Note that this PRT acronym is different from the aforementioned Army Physical Readiness Test (APRT), although the readiness training is closely related to the requirements for the readiness test. The studies took a control group (CG) of 1296 and 1138 troops (study one and two, respectively) using the Army's traditional Basic Training (BCT) physical training program during its 9-week cycle and compared them to an experimental group (EG) of 1284 and 829 troops, respectively, using PRT instead. In the two studies, 50% and 60% more (respectively) duty-time-loss due to overuse injury existed in the men and 40% and 50% more (respectively) in the women in the CG, although there were no significant differences in traumatic injuries. In the final APFT given at the end of the 9-week BCT, the EG had a greater proportion of recruits passing the test than the CG (men: 85% vs. 81%; women: 80% vs. 70%). After all APFT retakes, the gender-combined EG had a lower failure rate for the first study (1.6% vs. 3.7%) and (1.7% vs. 3.3%) for the second study. All of these results had statistical p-values under 0.05 (5%) which implies statistical significance of all results. Overall, the PRT program and its associated change in fitness training reduced overuse injuries and allowed a higher success rate on the APFT.

Reducing injuries appears to be an advantage in tailoring physical fitness programs to eliminate a lot of traditional military fitness activities (i.e., long runs on roadways instead of tracks) and focusing more on combat-required tasks (i.e., burst speed and anaerobic skills) instead of just fitness test events. Other opponents of the idea that general fitness tests can determine combat readiness may include the fact that it is highly unlikely to require a long-distance run in combat, or other associated highly aerobic

capabilities. However, it is likely that certain combat situations may require quick recovery from "bursts" of expended energy, or the ability to recover from periods of especially high heart rates as in times of combat and/or high stress levels.

In 1996, Israel's JR Hoffman from the Center for Combat Fitness's Department of Research did a study on the relationship between aerobic fitness and recovery from high-intensity exercise with 197 infantry from the Israeli Defense Force. Hoffman used a 2000m maximal effort run time as a measure of aerobic fitness, and compared this measure with the "slowing" times of three bouts of 140m sprints (with only 2 minute rests in-between bouts). It was found that recovery from high-intensity exercise is improved at higher levels of aerobic fitness, but as the level of aerobic fitness improves above the population mean, no further benefit in the recovery rate from high-intensity exercise is apparent (Hoffman, 1997). Implications of this study on fitness testing is that if a threshold of aerobic fitness is met (in this case, the population mean), then recovery rates as required in combat situations will likely be negligibly different in any of the personnel.

A second study involving fatigue (and thus its effect on recovery) that further supports these results was published in 1989 at the US Army Research Institute of Environmental Medicine (Natick, MA) by Patton, Vogel, Damokosh, and Mello. This study of three eight-man gun crews participating in an eight-day combat-simulated operation measured body composition and measures of fitness before and immediately following the scenario. Physical performance, intensity of physical activity, and amount of sleep were recorded throughout the operation. Measures of fitness were the isokinetic strength of the arms and legs, isometric handgrip strength, dynamic lifting, and upper

body anaerobic power. Physical performance was assessed by daily ratings from senior noncommissioned officers experienced in artillery operations. The intensity of physical activity and amount of sleep were estimated from continuously recorded heart rate using electrocardiographic tape recorders worn by the soldiers. The results showed a muscular strength and lifting capacity increase of 12%-18% post-operation, physical performance scores being the highest on the first and last days of the operation, the mean amount of daily sleep being 5.3 hours (with a 1.3 hour standard deviation), and the average amount of time per day above 50% and 75% of maximal heart rates were, respectively, 22 minutes and 2.9 minutes. These results suggest that on average, soldiers allowed at least 5 hours of sleep who are required to perform at moderate levels of physical intensity show no loss in physical fitness capacity or evidence of physical fatigue during (simulated) combat operations.

A third study done in June 1985 by Pleban, Thomas, and Thompson of the Army Research Institute for the Behavioral and Social Sciences (Alexandria, VA) evaluated 16 male Reserve Officer Training Corps (ROTC) cadets on cognitive work capacity and fatigue onset under sustained combat operations, as moderated by physical fitness. They were evaluated using five fitness indices: the Harvard step test (5 minutes of 30 steps per minute onto a step 45 centimeters above the ground, then measure heart rate recovery times), chin-ups, pushups, sit-ups, and a two mile run, as well as on cognitive and subjective measures of fatigue state, before, during, and one day after the two and a half day Pre-Ranger Evaluation exercise. The study's results suggested that fitness may ease the loss of cognitive work capacity for certain tasks requiring prolonged mental effort, and may also help to moderate the rate of fatigue. However, fitness did not significantly

enhance the recovery process with respect to cognitive work capacity, and actually appeared to hinder recovery from fatigue. In other words, this study shows that fitness may help keep people from not operating at their best physically and mentally during sustained combat operations, but unfortunately once people are fatigued or mentally drained, fitness may actually hurt people from mental and/or physical recovery.

Combining these three study conclusions could persuade one to believe that if the military sets a proper threshold for aerobic ability for its people, and allows for moderate daily physical activity with at least five hours of sleep per night, then it is unlikely that there will be any mental or physical fatigue onset and thus no hindrance or need for a recovery process (deemed critical during sustained combat operations). This further implies that since combat operations typically require at least moderate physical activity, testing for physical "readiness" may essentially be as simple as ensuring normal sleeping patterns and a minimum aerobic ability. However, physical readiness and combat readiness may be different if the necessary combat skills or strength required to complete these combat skills are not ensured.

Thus far, the two main ideas being expressed are the concept of a general fitness test and the concept of a work/job-task related fitness test (and specifically in the case of military members, a combat-task related fitness test). However, some militaries have explored a third option, which is a fitness test with different standards and minimum passing scores on each event of the test being dependent on which unit, or which job, the person is in. This is the standard practice for the Royal Thai Armed Forces. Even though the Thai military has a standard physical fitness test for all of their personnel, they determined that an OCC that requires more strength should have higher minimum passing

scores on strength-related assessments within that standard physical fitness test (Panichkul et al., 2007). This is a reasonable suggestion to ensure strength requirements are met for each OCC. However, as was mentioned previously, this does not ensure that all military members with the ability to deploy to a combat zone and face combat-required tasks are capable of doing so.

Chapter Summary

This literature review chapter discusses the progression of fitness and fitness testing throughout the past 100 years in the United States, and specifically, in the different military services. It concludes with a listing of many advantages and disadvantages of different methods for fitness training and testing used throughout the world. The next chapter covers the methodology of the data collection specific to this research: volunteer physiological data as well as fitness testing results from the Air Force Physical Fitness Test per AFI 10-248, the proposed Army Physical Readiness Test per Draft FM 3-20.20, and the Marine Combat Fitness Test per Marine Corps Orders 6100.B and 6100.3J.

III. Analysis

Chapter Overview

This chapter begins with a summary of the protocol and its amendments, the data collection process, and the methodology behind this research, and then leads into the analysis of the collected data. The analysis utilized JMP® software incorporating distributions, regressions, ANOVA, and non-parametric hypothesis testing, and well as Excel® software to manage and organize the data and to incorporate contingency table chi^2 hypothesis tests. The goal of the analysis was to design models utilizing the most predictive events from all of the fitness tests, thereby offering improved opportunities for the Air Force, or other services, to predict combat capability for their personnel. Lastly, the analysis will also explore the collected data in order to test the investigative questions such as if Body Mass Index (BMI) and/or waist circumference and performance measures of strength-oriented events are independent of each other.

Data and Methodology

The in-depth details of the methodology for this research are explained in the approved protocol (see Appendix A), which received Institutional Review Board (IRB) approval on 19 June 2008, an initial approval letter dated 22 September 2008 (see Appendix H), and an amendments approval letter dated 22 October 2008 (see Appendix J). The amendment was necessary to the research protocol due to two changes in the proposed methodology of data collection.

The first change was simply due to the IRB process taking many months longer than anticipated, and the originally proposed testing period of July 2008 until October

2008 had already passed. Therefore the testing period had to be amended to extend until February 2009. The second change was simply the Wright-Patterson Air Force Base (WPAFB) fire department being unable to donate one of their two dummies for use in the MANUF event, as originally proposed in the protocol. The WPAFB fire department had said they had two dummies available, one weighing 120lbs and another at 180lbs. After reviewing a study by Swiderski (2005) showing that the average weight of adult Air Force personnel was 180lbs, it was decided to utilize both fire department dummies, and have those personnel under 180lbs (below average weight) use the 120lbs dummy and those over 180lbs (above average weight) use the 180lbs dummy. However, the fire department required the use of their 120lbs dummy for a training scenario and was unable to donate it to this research. The decision was made to proceed with just the single 180lbs dummy for all volunteers. An amendment to the protocol was submitted with these two changes and approved on 22 October 2008, as seen in Appendix J. Data collection began less than a week later, with the first of the 32 testing sessions commencing on 28 October 2008.

Collected data was in the form of performance measures of all events on the Air Force Physical Fitness Test, the Army PRT, and the Marine CFT. Tests were to be taken as close as possible to each other chronologically in order to limit changes in physical capabilities over time, but with a minimum of one week between tests for resting purposes. A majority of volunteers were recruited from the Air Force Institute of Technology (AFIT), which has a requirement for students to test on the Air Force Physical Fitness Test each October, which was almost entirely completed by the time this research's data collection began on 28 October 2008. Besides the event performance

measures, additional data collected included height, weight, sex, age, career field, date of tests, a self-reported value between 0 and 10 answering the question, “On a scale from 0-10: How much exercise other than pushups, sit-ups, and running do you feel you do?”, as well as descriptions of the footwear and clothing being worn during each event tested. Since there was one outdoor event for both the Army PRT and the Marine CFT, it was determined that some volunteers wearing heavier clothes or heavier boots in poor weather may have an effect on performance. The date of tests was recorded so a meteorological database could be referenced if necessary to capture data on outside weather conditions and temperature.

The research question is based on combat capability, which is clearly evaluated differently among different military services throughout the world. For this reason, rather than picking which of the two combat tests (Army PRT or the Marine CFT) is a better measure of combat capability, equally weighted stratifications on the Army PRT and the Marine CFT were used to simulate the dependent variable called “combat capability”. The Army test had six equally weighted events that had their own mean times/distances/repetitions and their own standards of deviation. The Marine test had three equally weighted events that had their own mean times/repetitions and their own standards of deviation. Each volunteer was given a Z-score based on each of their individual event performance measures. Z-scores were then normalized between 0 and 1 in order to give individuals a percentile rank among their peers for each event. Percentile ranks were then converted to a point score between 0 and 100, where any volunteer falling into the bottom 10 percentile received no points (considered “failing”) and those in the top 10 percentile received all 100 points (considered “maxing”). Those percentile

ranks between the bottom 10 percent and the top 10 percent of each event received a score between 0 an 100 based on a normal distribution of the middle 80 percent of volunteers and a mean score of 50. This methodology is similar to the way the Army designs their scoring charts when creating new fitness test events, effectively eliminating the outlier poor or excellent performers from the distribution of data.

For the Army test, there were six events so the total "Army Composite" had a range of up to 600 points. For the Marine test, there were three events so the total "Marine Composite" had a range of up to 300 points. The "Combat Composite" was 50% Army Composite and 50% Marine Composite, so the Marine Composite points were doubled to end with a total point range between 0 and 1200 points. Like with the individual events, Combat Composite scores from all volunteers were used to calculate a mean and a standard deviation, and Z-scores were created and then utilized to form a percentile rank. This Combat Composite is a proxy for the stratified measure of combat capability among this group of peers.

This same process was also done utilizing Air Force fitness test results for each of the volunteers, since volunteers were required to submit their Air Force Portal print-outs of their latest Air Force fitness test results. Each event performance measure on the Air Force test (waist circumference if BMI over 25, 1.5 mile run time, 1 minute pushups repetitions, and 1 minute sit-ups repetitions) were recorded as both raw data and again as the Air Force points rewarded per the appropriate charts that determine event point totals based on sex and age (see Appendix K). Since the Air Force currently uses these events and these charts within their Fit-To-Fight program, these point totals serve as the baseline for this study. The main research objective was to see if these point totals had significant

association with the combat capability stratifications, and to see if statistical programs could offer an improved association utilizing these events without the current Air Force sex and age charts.

The Air Force Fitness Test and its Association with Combat Capability

A restatement of the research questions are as follows:

> Is the current Air Force fitness program sufficient for meeting our evolving combat roles and requirements? If not, what easily testable fitness events or easily collectable data specific to each subject are good predictors of combat fitness which may be used to improve upon the Air Force fitness program?

In order to answer these questions, it is first required to see how well the AFPFT, as it is today, associates with combat capability. Through JMP®, it is possible to run volunteer stratifications, based on their composite Air Force score (which is based on the sex and age charts found in Appendix K), to a "Fit-Y-by-X" analysis, where Y is the volunteer stratifications based on Combat Composite and the X is the Air Force test volunteer stratification. The result is a summary of fit showing how well standing among your peers on the Air Force test predicts standing among your peers on Combat Composite. This model has an adjusted R^2 of 0.22764 and is shown in Figure 1. Additionally, it is possible to see how well the Air Force Composite score alone (based on the age/sex charts of Appendix K) predicts subjects combat capability by running a "Fit-Y-by-X" analysis with Y as the Combat Composite and the X as the Air Force Composite. This is shown in Figure 2, and has an adjusted R^2 of 0.204526. The red lines on Figures 1 and 2 are the regression lines that JMP® used to determine the adjusted R^2 values.

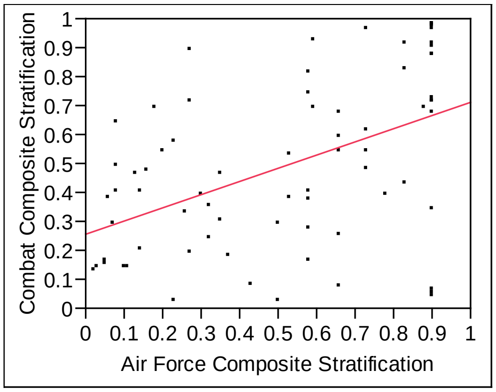

Figure 1. Bivariate Fit of Combat Composite Stratification by Air Force Composite Stratification

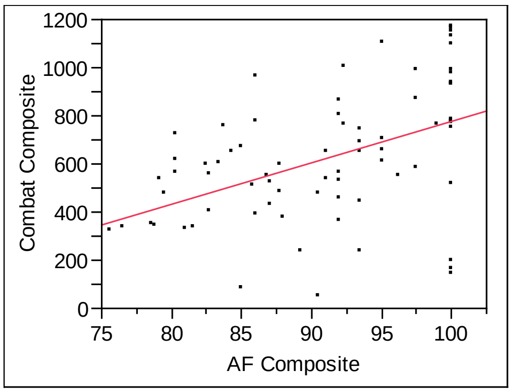

Figure 2. Bivariate Fit of Combat Composite by Air Force Composite

The hypothesis that the current Air Force fitness test has a poor capability of predicting combat capability is strongly supported due to the low adjusted R^2 values associated with these two analyses. As the test stands, not even 23% of the Combat Composite score or a persons' stratification among their peers in terms of combat capability can be explained with their stratification or results on the Air Force PFT. These conclusions leads to the next step in the analysis, which is to determine if JMP® can arrive at a better method of scoring personnel on the Air Force test in order to better predict combat capability than the current charts as seen in Appendix K. The way to do this is to run a "Fit Model" analysis using all the variables as found in the Air Force test

and have the response variable, Y, be Combat Composite. This utilizes the raw data (not stratified or using charts) variables: age, sex, BMI (since a BMI under 25 exempts the waist circumference measurement), waist circumference, 1.5 mile run, Air Force pushups, and sit-ups. This model has an adjusted R^2 of 0.737415 and is shown in Figure 3. Parameter estimates of this model are shown in Table 2. Because there are multiple independent variables in this model, three lines are shown in Figure 3 – the center line shows the regression line and the two curved lines on either side of the regression line show the 0.05 significance curves (also known as confidence intervals) for the model.

For the parameters in the model, each independent variable has an associated estimated value β_i within the equation $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_n x_n + \varepsilon$, from i = 1 to n where y is the dependent variable, n is the total number of independent variables, β_0 is the intercept, and ε is the error. In Table 2 and future parameter estimate tables, "Std Error" is the estimated standard error of the coefficient estimate (useful for constructing confidence intervals for these model parameters), "t Ratio" is the value of the parameter estimate divided by its standard error (used for testing the individual null hypotheses that each coefficient is zero), "Prob>|t|" is the p-value for each variable (showing significant predictability in the model if under 0.05), "Std Beta" is the estimate that would be obtained if all variables in the model were standardized to zero mean and unit variance prior to performing the regression computations (shows the weighting of each variable within the model), and "VIF" is the variance inflation factor (VIF) which compares the relative degrees of statistical significance of the model with those of the partial regression coefficients (in order to reveal any possible colinearity).

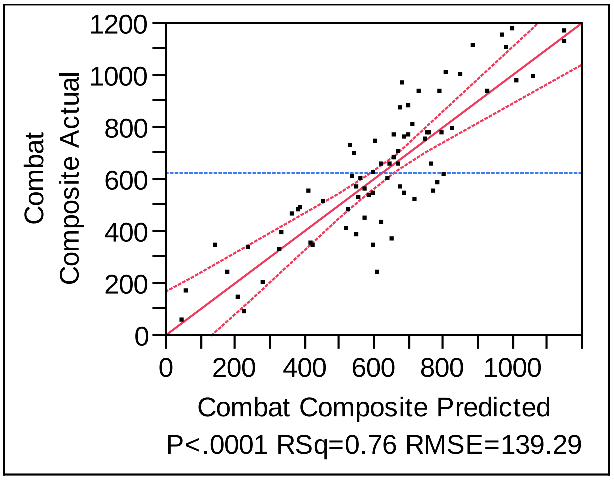

Figure 3. Regression Scoring Model of the Air Force Fitness Test

Table 2. Parameter Estimates for Air Force PFT Variables Model

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	681.28648	363.6305	1.87	0.0654	0	.
1.5-Mile Run	-1.745727	0.286022	-6.1	<.0001	-0.49282	1.812525
Abdominal Cir.	-15.13919	9.553431	-1.58	0.1178	-0.17668	3.455554
AF Pushups	7.8087246	2.827437	2.76	0.0074	0.282829	2.915585
Sit-Ups	5.3415374	3.233552	1.65	0.1033	0.1485	2.246631
Sex[F]	-126.8299	41.96699	-3.02	0.0036	-0.23583	1.692927
BMI	22.16053	8.832978	2.51	0.0146	0.259993	2.985585
Age	6.1035928	3.114638	1.96	0.0543	0.134877	1.316953

As shown in Table 2, this model estimates positive values for both BMI (significant p-value) and age (non-significant p-value), suggesting that being older and having a higher BMI predicts higher combat capability. However, abdominal circumference (non-significant p-value) shows a negative estimate implying that larger waist measurements predict lower combat capability, which may appear contradictory to the estimate of the BMI being positive (this, however, is because BMI and abdominal circumference are not measuring the same thing). The adjusted R^2 of this model is 73.74%, which is a significant improvement over the current sex-age scoring charts

method. It, however, is not perfectly accurate because the scoring causes a bias in the raw data for both the pushups and the sit-ups, because the charts (see Appendix K) have pre-existing maximum scores. In some cases, a subject may stop at the maximum even though they have the ability to continue since they already received the maximum score, and they are likely considering saving that remaining energy for their next event.

There are no events on the Marine CFT or the Army PRT that do sit-ups without a maximum, so for the model's sake there is no alternative to using any other sit-up data other than the biased Air Force sit-up results. These sit-up results are only moderately-predictive and will not help to raise the adjusted R^2 for the model (in fact, with sit-ups removed the adjusted R^2 drops just 0.68% to 73.06%). This is evident with the sit-ups' 0.1033 p-value being higher than the typical threshold of the standard statistical level of significance of 0.05. Sit-ups raw data and sit-ups points distributions are shown in Figures 4 and 5, respectively. It is clear that the scoring charts for the sit-ups are too easy when 85.366% of subjects got to or exceeded the maximum for sit-ups. This likely causes a limited range in the number of repetitions, and a lower level of predictability in the variable itself.

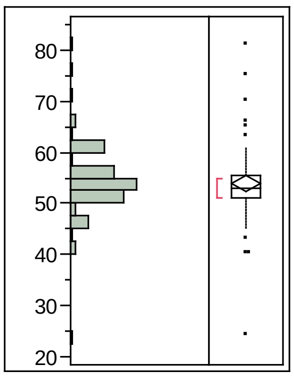

Figure 4. Sit-Ups Distribution

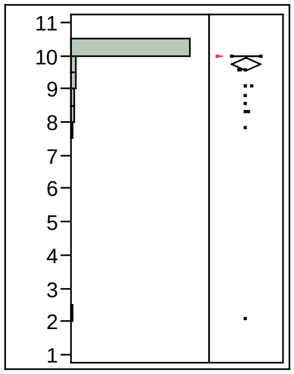

Figure 5. Sit-Ups Points Distribution

Pushups on the Air Force test are also limited by the fact that there is a maximum on the scoring charts. The pushup raw data and points distributions, in Figures 6 and 7, respectively, show the vast majority of test takers stopping in the 50-60 pushups range, which on the charts, is the range where the maximum of 10 points is received. Like with the sit-ups, a maximum will likely have the effect of limiting the range of output from the subjects because less of them are likely to continue their efforts after achieving the maximum points. In this study, 76.829% of all subjects are receiving the maximum points. Like the sit-ups scoring charts, this high number implies that the pushup scoring charts are likely set too easy to achieve that maximum as well.

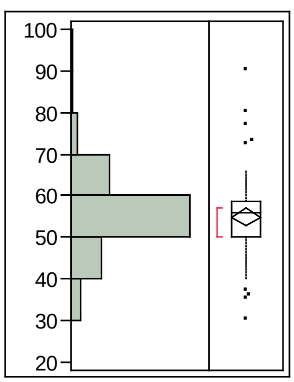

Figure 6. Air Force Pushups Distribution

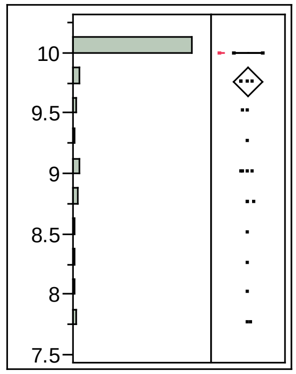

Figure 7. Air Force Pushups Points Distribution

However, an interesting alternative to the use of the Air Force pushups is the Army Pushups, even though the p-value of the Air Force pushups was 0.0074, which is considered predictive since it is less than then the 0.05 threshold. In the Army PRT, there was no pre-existing maximum score. Volunteers knew they were being scored based on their stratification among the other test takers. This had a significant effect on the distribution of scores. Although the mean number of repetitions remained virtually unchanged, the range of repetitions increased dramatically. Those who usually achieved the maximum points “easily” went above and beyond that point whereas those who had to exert all of their efforts to achieve maximum points tended to conserve a little more of their energy for the future events (the pushups came directly before the 1 mile run on the Army PRT). This distribution is shown in Figure 8.

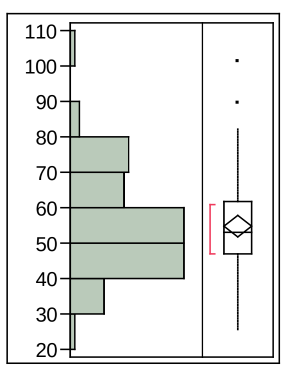

Figure 8. Army Pushups Distribution

For the Fit Model analysis designed to see if the Air Force test can have better predictability of combat capability than the current scoring charts, the Air Force pushups (with their respective bias due to chart maximums) have been replaced with the Army PRT pushups. The new model is shown in Figure 9, and has an adjusted R^2 of 0.767943. Parameter estimates for this model are shown in Table 3.

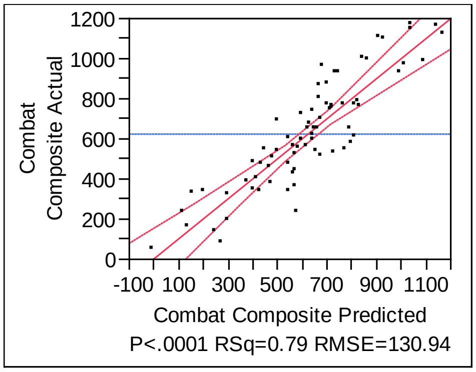

Figure 9. Regression Scoring Model of the Air Force Fitness Test using Army Pushups

Table 3. Parameter Estimates for Model with Army Pushups

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	552.13747	337.5704	1.64	0.1067	0	.
1.5-Mile Run	-1.530796	0.27852	-5.5	<.0001	-0.43215	1.944793
Abdominal Cir.	-9.069019	9.189113	-0.99	0.3273	-0.10584	3.617598
Sit-Ups	6.0948839	2.763169	2.21	0.0309	0.169443	1.856355
Sex[F]	-137.9014	37.2013	-3.71	0.0004	-0.25642	1.505264
BMI	19.181826	8.359512	2.29	0.0249	0.225046	3.025875
Age	2.133597	2.733356	0.78	0.4378	0.047148	1.147683
Army Pushups	6.518707	1.566657	4.16	<.0001	0.328577	1.961668

In this model, the <0.0001 p-value for the Army pushups was even lower than the p-value of 0.0074 for the Air Force pushups. This is what aided in increasing the adjusted R^2 3.05% from 73.74% to 76.79% (relative improvement of 4.1362%). This is the best predictability that can result from utilizing our current events in the Air Force test. However, in this model, age (p-value of 0.4378) and abdominal circumference (p-

value of 0.3273) have no significant predictability, and sit-ups (p-value of 0.0309) are still below the 0.05 threshold. It is possible to slightly improve this model's adjusted R^2 (raising it from 76.79% to 76.93%, for a relative improvement of 0.2476%) by removing the age variable from the scoring model altogether, or to 77.03% (even higher still, relative improvement of 0.13%) by removing abdominal circumference as well. This final model is shown in Figure 10, with parameter estimates shown in Table 4.

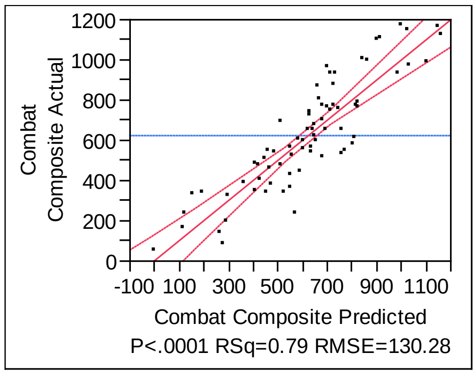

Figure 10. Regression Scoring Model of the Air Force Fitness Test w/o Age or Abdominal Circumference

Table 4. Parameter Estimate for Maximized Air Force PFT Variables

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	460.33813	275.4428	1.67	0.0993	0	.
1.5-Mile Run	-1.510253	0.276493	-5.46	<.0001	-0.42635	1.936206
Sit-Ups	6.0335513	2.658777	2.27	0.0264	0.167738	1.736335
Sex[F]	-122.2652	33.20634	-3.68	0.0005	-0.22735	1.211609
BMI	12.7975	5.406777	2.37	0.0208	0.150143	1.278762
Army Pushups	6.9132022	1.511682	4.57	<.0001	0.348461	1.84511

Note that all remaining variables have p-values under the 0.05 threshold. In all models, BMI actually has a positive estimate which implies that higher BMI values equate to higher Combat Composite predictions. Being a female has a negative estimate which implies that being a female equates to lower Combat Composite predictions. The predictive events themselves have logical estimates -- faster run times (a negative

estimate) and higher repetitions on sit-ups and pushups (positive estimates) equate to higher Combat Composite predictions.

Possible Alterations to the Air Force Fitness Test

As it stands now, the Air Force Fitness test is under the 23% mark when it comes to predictability of combat capabilities (assuming Combat Composite as a proxy for combat capability). That same test, when the current sex and age scoring charts are removed and regression modeling is left to scoring, can improve to over 77% in terms of predictability of combat capabilities (relatively, a 335% improvement). However, are there significantly predictive events that volunteers took during the Army PRT or the Marine CFT that when included in our Air Force test, or used to replace a less predictive event on the Air Force test, can push that predictability mark even higher?

The first step to figuring this out is to check each variable for individual predictability when plotted against the Combat Composite. The best way to accomplish this is through individual "Fit-Y-by-X" bivariate plots of Combat Composite to each variable, as seen in Appendix M, as well as scatterplots, as seen in Appendix L. The bivariate plots are essentially a model analysis but with just the one variable being tested. If the R^2 of the model with just the single variable is significantly high, and the p-value is under the 0.05 threshold, then that variable is considered significantly predictive. A scatterplot serves the same purpose visually, allowing at a quick glance the opportunity to see trends such as data in a line or in a curve that likely points to either linear or polynomial relationships between the variable in question and the Combat Composite. Table 5 shows a summary of the bivariate analysis and each variable's respective adjusted R^2 values.

For each bivariate plot, if a second degree polynomial fit does not improve the adjusted R^2 significantly, or the fit simply does not make sense (i.e., low age and high age being the peaks in terms of combat capability and the middle age groups being the valley), then only a linear fit was attempted. Three second degree polynomial fits were found to be statistically significant (although they had relatively low associated adjusted R^2 values), representing curves steadily increasing to a maximum before beginning a downturn. The first of these was height, which predicted a Combat Composite of 0 at about 56 inches in height, rising to a maximum predicted Combat Composite of 650 at about 71 inches in height, then lowering to a predicted Combat Composite of 550 at about 77.5 inches in height. The second of these was weight, which predicted a Combat Composite of 175 at a weight around 100 pounds, rising to a maximum predicted Combat Composite of 700 at a weight around 185 pounds, then lowering to a predicted Combat Composite of 350 at a weight around 260 pounds. The final polynomial variable was BMI, which predicted a Combat Composite of 300 with a BMI around 18, rising to a maximum predicted Combat Composite of 700 with a BMI around 27, then lowering to a predicted Combat Composite of 250 with a BMI around 36.

Table 5. Adjusted R^2 Values of Bivariate Analysis Variables

	Linear			Polynomial	
Continuous Variables	Adj R^2	P-value	Cat. Num.	Adj R^2	P-value
Height	0.0324	0.0677	-	0.093	0.0185
Weight	0.0024	0.2824	-	0.1169	0.002
BMI	-0.0123	0.7352	-	0.031	0.0438
Age	0.0077	0.2146	-		
0-10 Variation	0.0835	0.0072	0		
Long Jump	0.3672	<0.0001	2		
Squats	0.1577	0.0003	1		
Shuttle Run	0.6972	<0.0001	4		
Army Pushup	0.5277	<0.0001	3		
1-Mile Run	0.4781	<0.0001	3		
Heel Hooks	0.4667	<0.0001	3		
1/2-Mile Run	0.6949	<0.0001	4		
30-lb. Lifts	0.4891	<0.0001	3		
MANUF	0.3145	<0.0001	2		
1.5-Mile Run	0.5263	<0.0001	3		
Abdominal Circumference	-0.0126	0.7668	-		
Air Force Pushup	0.4946	<0.0001	3		
Sit-Ups	0.4082	<0.0001	2		

LEVEL OF SIGNIFICANCE OF EACH EVENT		
Category	Range	Cat. Num.
non-predictive	<0.15	0
low-predictive	0.15-0.3	1
moderate-predictive	0.3-0.45	2
high-predictive	0.45-0.6	3
most-predictive	>0.6	4

Clearly the two most predictive variables are the Shuttle Run (from the Army PRT) and the 1/2-Mile Run (from the Marine CFT). Since both of these events are essentially sprints, which tests burst muscle capability, a model utilizing both of these events could be considered redundant. However, a model utilizing one of these is likely to maximize the predictability of the final model. This one event alone is almost as

predictive as the best possible method of scoring utilizing the variables on the current Air Force test.

Several strength events also fell into the highly predictive category: both Army and Air Force pushups, heel hooks (from the Army PRT), and the 30-lb. lifts (from the Marine CFT). Army pushups are slightly more predictive and do not have the bias of a maximum on the existing scoring sheets, and so they will be used instead of the Air Force version. Since it is not useful to design a model with the maximum adjusted R^2 if it is too long or too complicated of a test to be utilized, the plan of attack was to create several “best models” based on two factors: (1) How many events will be on the test? and (2) Does one of the events have to be a distance run (1/2-mile, 1-mile, or 1.5-mile)?

Tables were created to ensure that all possibilities of the highly-predictive variables were utilized. The best model was then selected from each category (i.e., 3-event test with a run required, 4-event test without a run, etc.) and then re-analyzed including the variable “sex.” This was done because the bivariate analyses did not include “sex” since it was a nominal variable rather a continuous variable, and therefore its effect on the adjusted R^2 of each model is unknown. The only stipulation for the iterations was that the test would have either zero or one distance run (1/2-mile, 1-mile, or 1.5-mile). These iterations and each associated adjusted R^2 are shown in Table 6 (including a distance run) and Table 7 (not including a distance run), respectively.

Table 6. Two-Event Model Iterations, Including a Distance Run

1.5-Mile Run	X	X	X	X	X
1-Mile Run					
1/2-Mile Run					
Shuttle Run	X				
Army Pushups		X			
30-lb. Lifts			X		X
Heel Hooks				X	
Sex					X
Adjusted R^2	**0.7465**	**0.6599**	**0.7575**	**0.6667**	**0.765**
1.5-Mile Run					
1-Mile Run	X	X	X	X	X
1/2-Mile Run					
Shuttle Run	X				
Army Pushups		X			
30-lb. Lifts			X		X
Heel Hooks				X	
Sex					X
Adjusted R^2	**0.7509**	**0.6013**	**0.7608**	**0.6378**	**0.7692**
1.5-Mile Run					
1-Mile Run					
1/2-Mile Run	X	X	X	X	X
Shuttle Run	X				
Army Pushups		X			
30-lb. Lifts			X		X
Heel Hooks				X	
Sex					X
Adjusted R^2	**0.7532**	**0.759**	**0.8514**	**0.7591**	**0.8493**

Table 7. Two-Event Model Iterations, No Distance Run

1.5-Mile Run							
1-Mile Run							
1/2-Mile Run							
Shuttle Run	X	X	X				X
Army Pushups	X			X	X		
30-lb. Lifts		X		X		X	X
Heel Hooks			X		X	X	
Sex							X
Adjusted R^2	**0.7946**	**0.8043**	**0.7579**	**0.722**	**0.6551**	**0.6072**	**0.8054**

The best two-event model in this case involves the 1/2-mile run and 30-lb. lifts, and reaches an adjusted R^2 of 85.14%. This is a 15.42% increase (or 22.12% relative improvement) over the best single event adjusted R^2 of 69.72% (shuttle run). This is also 8.11% higher (or 10.53% relative improvement) than the regression scoring model of the maximized Air Force PFT variables (Army pushups, sit-ups, 1.5-mile run, BMI, and sex), which had an adjusted R^2 of 77.03%.

The best three-event test was the 1/2-mile run, pushups, and the 30-lb. lifts. The adjusted R^2 increased from 85.14% to 88.19%, for an increase of 3.05% (or 3.58% relative improvement), by adding the pushups to the test. This iterative process is shown in Table 8 (including a distance run) and Table 9 (not including a distance run).

Table 8. Three-Event Model Iterations, Including a Distance Run

1.5-Mile Run	X	X	X	X	X	X	X
1-Mile Run							
1/2-Mile Run							
Shuttle Run	X	X	X				X
Army Pushups	X			X	X		
30-lb. Lifts		X		X		X	X
Heel Hooks			X		X	X	
Sex							X
Adjusted R^2	**0.8078**	**0.853**	**0.7909**	**0.8177**	**0.7328**	**0.782**	**0.851**
1.5-Mile Run							
1-Mile Run	X	X	X	X	X	X	X
1/2-Mile Run							
Shuttle Run	X	X	X				X
Army Pushups	X			X	X		
30-lb. Lifts		X		X		X	X
Heel Hooks			X		X	X	
Sex							X
Adjusted R^2	**0.8006**	**0.8663**	**0.7923**	**0.7984**	**0.6954**	**0.7807**	**0.8646**
1.5-Mile Run							
1-Mile Run							
1/2-Mile Run	X	X	X	X	X	X	X
Shuttle Run	X	X	X				
Army Pushups	X			X	X		X
30-lb. Lifts		X		X		X	X
Heel Hooks			X		X	X	
Sex							X
Adjusted R^2	**0.8112**	**0.8666**	**0.7953**	**0.8819**	**0.7974**	**0.8578**	**0.881**

Table 9. Three-Event Model Iterations, No Distance Run

1.5-Mile Run					
1-Mile Run					
1/2-Mile Run					
Shuttle Run	X	X	X		X
Army Pushups	X		X	X	X
30-lb. Lifts	X	X		X	X
Heel Hooks		X	X	X	
Sex					X
Adjusted R^2	**0.8712**	**0.8194**	**0.8209**	**0.7514**	**0.8699**

The current Air Force test has four events, but the abdominal circumference is a measurement that does not cause any physical fatigue; therefore, the Air Force test is technically only three physical events. The best three-event model is actually simpler to take than the current physical events on the Air Force test. The 1/2-mile run from the model requires the same track that the Air Force already uses for their 1.5-mile run, but is done in less than 1/3 the time. Pushups are already done for the Air Force test and so there are no complications to switching to the model's pushups event, with the minor change that there will no longer be scoring chart maximums. Dumbbells that weight 30-lbs. can be easily acquired for the final event in the model, and only takes two minutes to complete – just one minute longer than the Air Force's sit-ups event.

The best four-event test was the 1/2-mile run, shuttle run, pushups, and the 30-lb. lifts. By adding the shuttle run to the test, the adjusted R^2 increased from 88.19% to 89.80%, for an increase of 1.61% (or 1.84% relative improvement). It is important to note that the increase in adjusted R^2 is following the law of diminishing returns – for each additional input (event variable) the increase in output (adjusted R^2) is marginally less than from the previously added input. Additionally, it is important to note that the added event variable, the shuttle run, is very similar in muscle groups tested (burst leg strength) as is the 1/2-mile run which was in the model previously. Avoiding this logical redundancy would result in the selection of the 2nd best model for four-events, which includes the 1.5-mile run, shuttle run, pushups, and 30lb. lifts, for an adjusted R^2 of 88.97%, or an increase of just 0.78% (or 0.88% relative improvement). This iterative process is shown in Table 10 (including distance runs) and Table 11 (not including distance runs.

Table 10. Four-Event Model Iterations, Including a Distance Run

1.5-Mile Run	X	X	X	X	X
1-Mile Run					
1/2-Mile Run					
Shuttle Run	X	X	X		X
Army Pushups	X	X		X	X
30-lb. Lifts	X		X	X	X
Heel Hooks		X	X	X	
Sex					X
Adjusted R^2	**0.8897**	**0.8315**	**0.8598**	**0.828**	**0.8881**
1.5-Mile Run					
1-Mile Run	X	X	X	X	X
1/2-Mile Run					
Shuttle Run	X	X	X		X
Army Pushups	X	X		X	X
30-lb. Lifts	X		X	X	X
Heel Hooks		X	X	X	
Sex					X
Adjusted R^2	**0.8888**	**0.8253**	**0.8703**	**0.8099**	**0.8872**
1.5-Mile Run					
1-Mile Run					
1/2-Mile Run	X	X	X	X	X
Shuttle Run	X	X	X		X
Army Pushups	X	X		X	X
30-lb. Lifts	X		X	X	X
Heel Hooks		X	X	X	
Sex					X
Adjusted R^2	**0.898**	**0.8339**	**0.8712**	**0.8841**	**0.8967**

Table 11. Four-Event Model Iterations, No Distance Run

1.5-Mile Run		
1-Mile Run		
1/2-Mile Run		
Shuttle Run	X	X
Army Pushups	X	X
30-lb. Lifts	X	X
Heel Hooks	X	X
Sex		X
Adjusted R^2	**0.8747**	**0.8738**

All three options utilizing five of the seven most predictive events result in an adjusted R^2 between 89% and 90%, for virtually no change over the best four-event model. The best is the 1/2-mile run, the shuttle run, pushups, 30-lb. lifts, and heel hooks, with an adjusted R^2 of 89.91%, for an increase of 0.11% (or 0.12% relative improvement). However, like the best four-event model, this also has the 1/2-mile run and shuttle run together, which implies a logical redundancy. The second best option that avoids this is the 1.5-mile run, shuttle run, pushups, 30-lb. lifts, and heel hooks, with an adjusted R^2 of 89.15% (an increase of 0.18% from the best four-event test avoiding the same issue, or 0.20% relative improvement). It is clear that diminishing returns have halted the gains of adding additional events, even with the most highly predictive events. Utilizing less predictive events will cause the diminishing returns to act even faster. The five-event iterative process is shown in Table 12. A summary of best models for each number of events (from one to five) is shown in Table 13. If the best model has the logical redundancy of the 1/2-mile run and the shuttle run being together on the same test battery (as in the four and five-event best models), the 2nd best model for each of those cases are also listed.

Table 12. Five-Event Model Iterations

1.5-Mile Run	X				X
1-Mile Run		X			
1/2-Mile Run			X	X	
Shuttle Run	X	X	X	X	X
Army Pushups	X	X	X	X	X
30-lb. Lifts	X	X	X	X	X
Heel Hooks	X	X	X	X	X
Sex				X	X
Adjusted R^2	0.8915	0.8902	0.8991	0.8978	0.89

Table 13. Summary of Best Adjusted R^2 Models

	1-Event	2-Event	3-Event	4-Event	4-Event*	5-Event	5-Event*
1.5-Mile Run					X		X
1-Mile Run							
1/2-Mile Run		X	X	X		X	
Shuttle Run	X			X	X	X	X
Army Pushups			X	X	X	X	X
30-lb. Lifts		X	X	X	X	X	X
Heel Hooks						X	X
Sex							
Adjusted R^2	**0.6972**	**0.8514**	**0.8819**	**0.898**	**0.8897**	**0.8991**	**0.8915**
*Ensuring that 1/2-mile run and the shuttle run were both not in the model together							

Inferential and Descriptive Model Diagnostics

The efficiency of the models in achieving a maximum predictability of combat capability was the highest in the models with fewer events. For this reason, the two-event and the three-event models will be the ones examined in terms of statistical diagnostics. The two-event model (adjusted R^2 of 85.14%) is shown in Figure 11, with parameter estimates in Table 14. The three-event model (adjusted R^2 of 88.19%) is shown in Figure 12, with parameter estimates in Table 15.

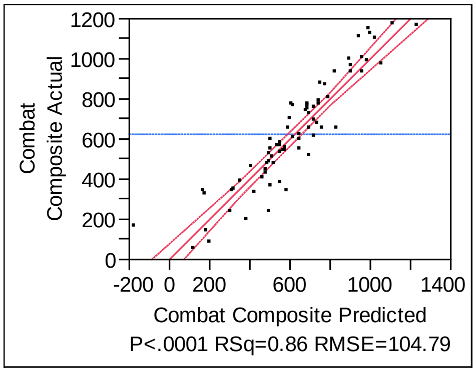

Figure 11. Two-Event Best Model, Pre-Exclusions

Table 14. Two-Event Best Model Parameter Estimates, Pre-Exclusions

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	1876.8281	150.537	12.47	<.0001	0	.
30-lb. Lifts	5.3221915	0.607312	8.76	<.0001	0.433837	1.203707
1/2-Mile Run	-9.21382	0.693585	-13.28	<.0001	-0.65764	1.203707

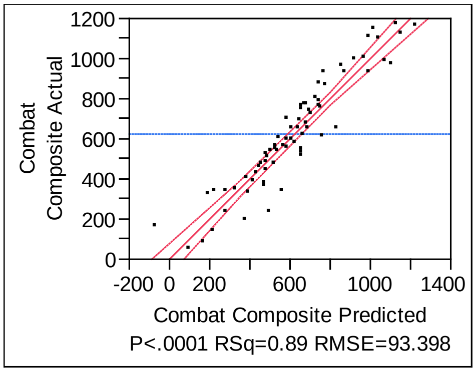

Figure 12. Three-Event Best Model, Pre-Exclusions

Table 15. Three-Event Best Model Parameter Estimates, Pre-Exclusions

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	1324.5586	183.6861	7.21	<.0001	0	.
Army Pushups	4.6613819	1.058893	4.4	<.0001	0.234958	1.76139
30-lb. Lifts	4.7980626	0.554223	8.66	<.0001	0.391113	1.261947
1/2-Mile Run	-7.365663	0.747262	-9.86	<.0001	-0.52573	1.758908

Both models will be run through a series of descriptive and inferential tests, and the outcomes of each will be explained. Any discrepancies from ideal outcomes and the likely data points leading to these possible discrepancies will be described. If necessary, data points with explanations as to why they are negatively affecting the diagnostics testing will be excluded in order to pass one or a multitude of the inferential tests. This will lead to the verification of the validity of these two models.

1) <u>Normality of Residuals & Outliers Tests</u>

The histogram of studentized residuals should appear normally distributed and there should be a very limited number of data points falling beyond three standard

deviations from the mean (the empirical rule states 99.7% of values in a normal distribution should fall within this range). Figure 13 shows the normality of the residuals analyses of the two models. The Shapiro-Wilk test checks the goodness of fit for normality on this data, and its p-value must be >0.05 to not reject the null hypothesis that the data is normally distributed.

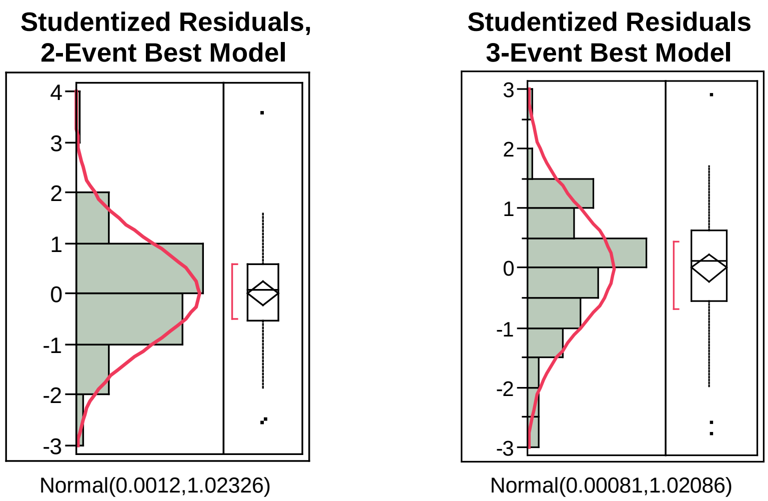

Figure 13. Normality of Residuals Analysis, Pre-Exclusions

These p-values are 0.1275 and 0.2681, for the two and three-event models, respectively, which are well above the necessary 0.05 to not reject the null hypothesis and pass the normality of residuals test. There are no data points beyond 3.528 standard deviations away from the mean for the two-event model and 2.87 for the three-event model, which implies the models have no residual outliers, and therefore pass the outlier test. However, it is later found during the Cook's Distance analysis that two data points in the set (#19 and #86) are considered overly-influential and need to be excluded. Therefore, these two tests and the remaining diagnostics tests will be run without these two data points. Figure 14 is the normality of residuals analyses of both models, post-exclusions.

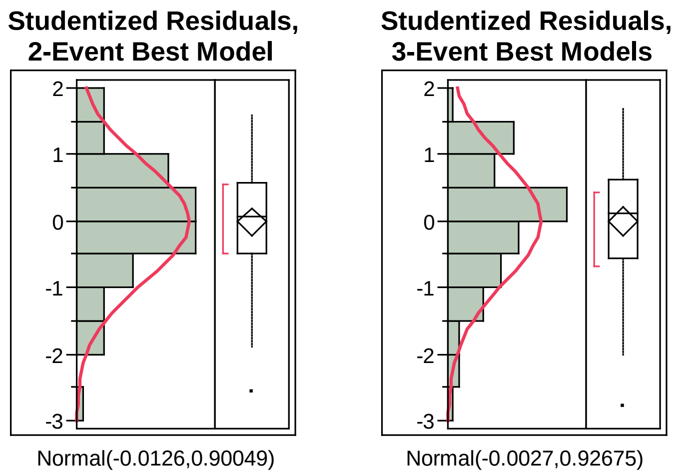

Figure 14. Normality of Residuals Analysis, Post-Exclusions

The final p-values after excluding the two data points were 0.2727 and 0.1231, which are both well above the 0.05 threshold for not rejecting the null hypothesis that the distributions of the residuals are normal. Additionally, 2.578 is the furthest sigma from the mean for the two-event model and 2.81 for the three-event test. Therefore, both models pass both of these tests.

2) <u>Constant Variance of Residuals</u>

A scatter plot of residuals vs. predicted for Combat Composite should have no trends and appear like a shotgun spread of points, as Figure 15 (pre-exclusions) and Figure 16 (post-exclusions) clearly show. When comparing these figures it is possible to see the dramatic narrowing of this shotgun spread, as evidenced by the changing axes scale. Besides a scatter plot, the Breusch-Pagan test is the inferential way to ensure constant variance. In order to not reject the null hypothesis that there is constant variance, the Breusch-Pagan test statistic must result in a p-value of >0.05. The results of these tests, as shown in Table 16, show that the p-values in these models are 0.9482 and 0.9044 for the two and three-event tests, respectively, which are clearly well above the 0.05 p-value necessary to assume constant variance.

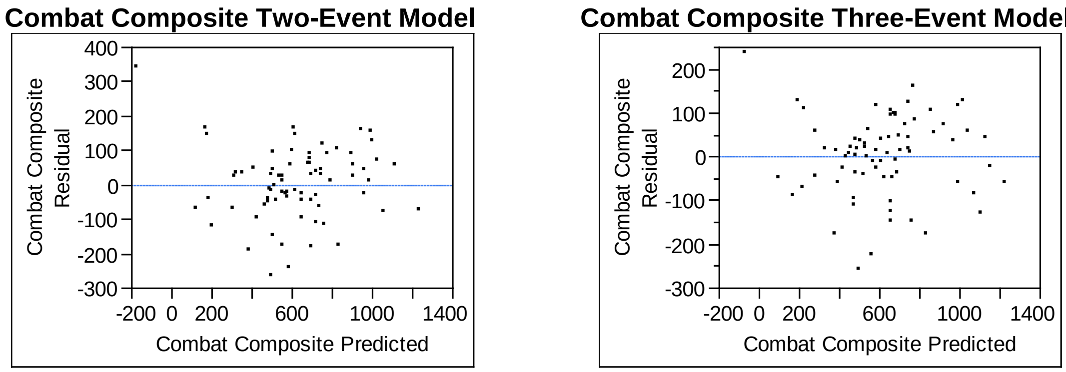

Figure 15. Constant Variance of Residuals Analysis, Pre-Exclusions

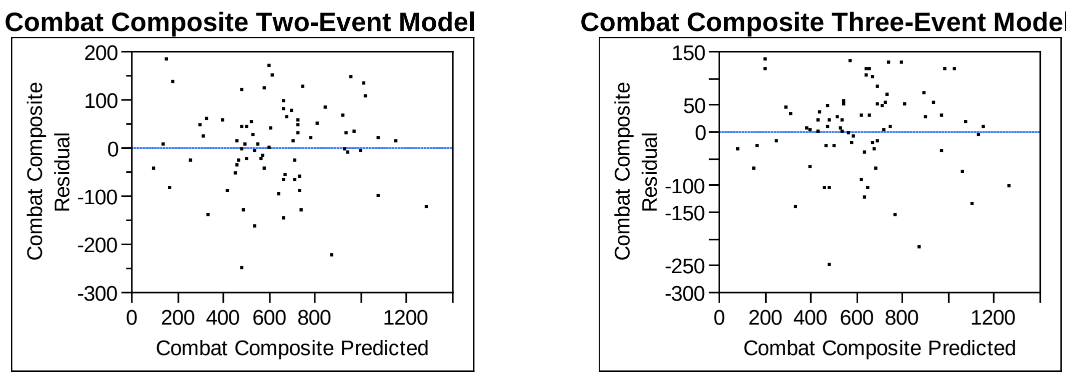

Figure 16. Constant Variance of Residuals Analysis, Post-Exclusions

Table 16. Breusch-Pagan Constant Variance Test Results

Breusch-Pagan Tests	2-Event Model	3-Event Model
SSR (from E^2 vs. X)	13255287.4	48935321.3
SSE (from Y vs. X)	568176.7	473802.5
n	72	72
B-P Test Statistic	0.106428344	0.565018601
DoF	2	3
P-value	0.948176918	0.904391742
alpha	0.05	0.05
Pass Bruesch-Pagan Test?	YES	YES

3) Independence of Residuals

A run chart should have no noticeable trend in the data, such as residuals larger over time due to the models missing something that should be included in the model. It is difficult to see any trends in either of the studentized residuals overlay plots, shown in

Figures 17 and 18 for the two and three-event models, respectively, and so there is likely independence of residuals on both models. There may be a slight upward trend for the last four or five data points, since all have positive residuals for both models, implying that these last four subjects did better on their combat composites than what the models predicted. These are unfortunately too few data points to properly check for dependence of residuals.

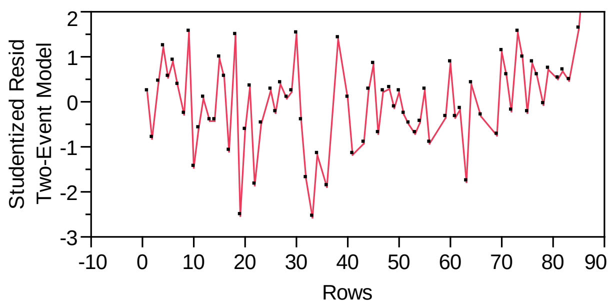

Figure 17. Independence of Residuals Analysis, Two-Event Model, Post Exclusions

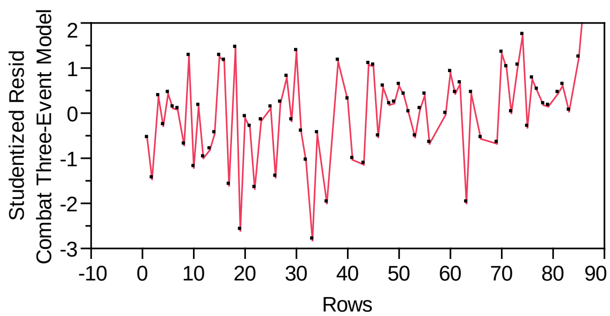

Figure 18. Independence of Residuals Analysis, Three-Event Model, Post-Exclusions

4) <u>Detection of Influential Data Points</u>

Cook's Distance is a measure of how influential data points are. In an ideal model all of these measures should be less than 0.25. Greater than 0.5 signifies a major influential point, 0.25-0.5 signifies a minor influential point, and less than 0.2 is considered insignificantly influential and acceptable without explanation. If a data point ends up being significantly influential, it is necessary to determine the reason why. If

there is a satisfactory explanation, it is possible to exclude the data point and re-run the Cook's Distance analysis to see if the model will pass without the overly influential data points. Figures 19 and 20 are the Cook's Distance plots for the two and three-event models, respectively. After running both models through the analysis, one major influential point (#86) as well as one minor influential point (#19) were identified. Both of these subjects had been noted during data collection as being possible outliers.

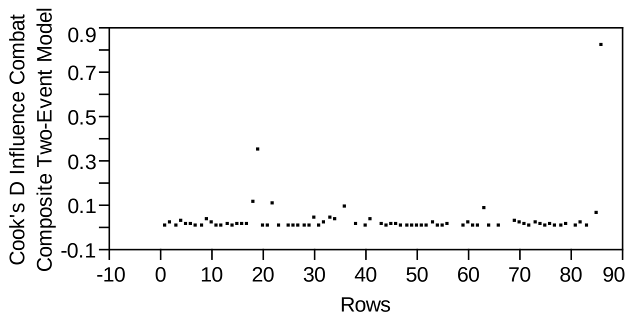

Figure 19. Influential Data Points Analysis, Two-Event Model Pre-Exclusions

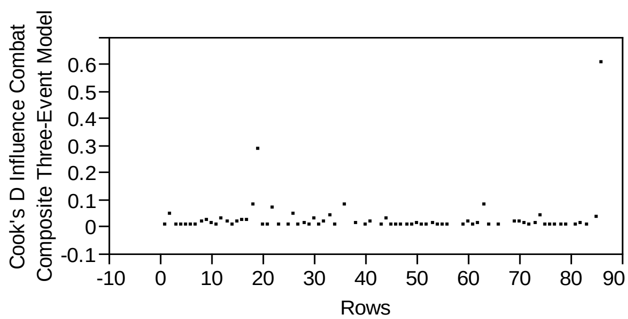

Figure 20. Influential Data Points Analysis, Three-Event Model Pre-Exclusions

Subject #19 had a very interesting method for doing the 30-lb. lifts with the dumbbell (by holding it vertically instead of horizontally) and the investigator administering the test was uncertain as to whether or not to permit this method. It was eventually considered allowed because nowhere in the Marine CFT event descriptions does it specifically say that method is prohibited. The reduced distance of travel of the dumbbell from the fully extended to the down position clearly led to a significantly

higher number of lifts than would have been expected by a subject of similar size and strength. This subject performed below the mean on every other event on both tests, yet managed to get 117 lifts for a stratification of 97th percentile for the 30-lb. lifts. No other test subject utilized this method for the 30-lb. lifts and therefore it is easy to explain why this subject's data should be excluded.

Subject #86 stood out immediately because of the vast disparity between the expected performance on the combat fitness events and the actual performance on the combat fitness events. This subject had a perfect 100 points out of 100 on the Air Force test (in the top 10th percentile of all subjects) and yet was stratified at the 16th percentile on the Army PRT with 162 points out of 600, the 2nd percentile on the Marine CFT with zero points out of 300, and the 5th percentile on the overall Combat Composite with 162 points out of 1200. This subject not only had very little leg strength on the events that required burst speed, but had virtually no arm strength and could not perform on the events such as the 30-lb. lifts and the MANUF. Surprisingly though, this subject had very little body mass and was able to perform relatively well on the Army pushup event (51 repetitions, less than 4 from the mean). This one event of decent output among all the others of virtually no output is the reason why this subject's data is overly influential, and should be excluded.

Upon excluding the two outliers from the data set, new Cook's Distance plots were generated to see if any other data points became more influential in their absence, as shown in Figures 21 and 22 for the two and three-event models, respectively. None were found and all data points in the two-event model are under 0.11, and all data points in the

three-event model are under 0.08. Cook's Distance therefore confirms that the remaining data points are not overly influential to the models.

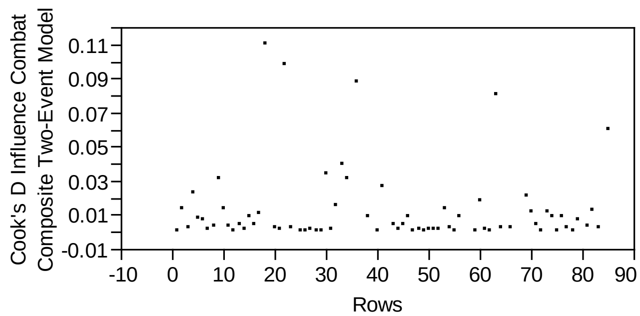

Figure 21. Influential Data Points Analysis, Two-Event Model, Post-Exclusions

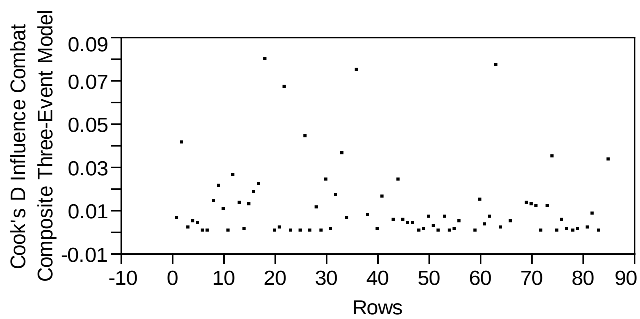

Figure 22. Influential Data Points Analysis, Three-Event Model, Post-Exclusions

If the two models are assessed for predictability with the remaining data points (and not the two excluded points), the adjusted R^2's increase to 88.52% and 90.28%, respectively. These models are shown in Figure 23 and Figure 24, and their parameter estimates are shown in Table 17 and Table 18. As was true prior to the exclusions, these models have logical variable estimates (positive for repetitions and negative for timed runs) and have statistically significant p-values.

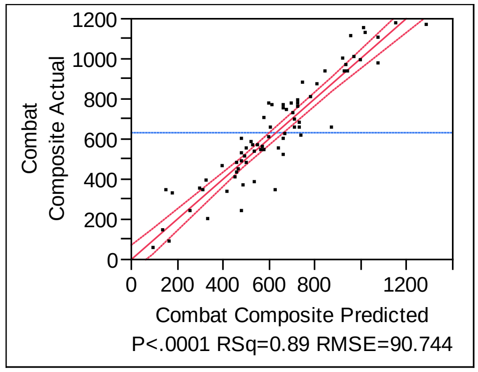

Figure 23. Two-Event Best Model, Post-Exclusions

Table 17. Two-Event Best Model Parameter Estimates, Post-Exclusions

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	1765.2078	137.99	12.79	<.0001	0	.
30-lb. Lifts	6.4732952	0.57561	11.25	<.0001	0.493935	1.192919
1/2-Mile Run	-9.089935	0.635376	-14.31	<.0001	-0.62835	1.192919

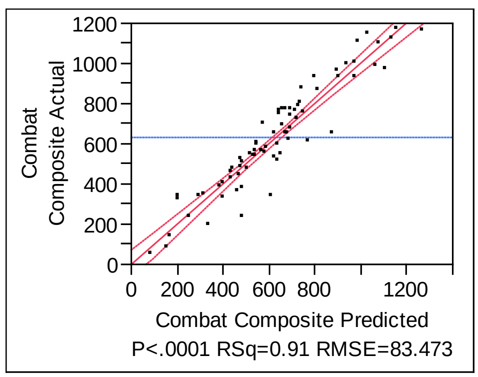

Figure 24. Three-Event Best Model, Post-Exclusions

Table 18. Three-Event Best Model Parameter Estimates, Post-Exclusions

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	1339.1334	171.7997	7.79	<.0001	0	.
30-lb. Lifts	5.8866984	0.552957	10.65	<.0001	0.449176	1.301016
1/2-Mile Run	-7.59029	0.712487	-10.65	<.0001	-0.52469	1.772757
Army Pushups	3.6253556	0.985073	3.68	0.0005	0.187123	1.889296

Non-Parametric Comparison of Medians

An interesting finding when collecting data was the disparity between performances from women, even with significantly higher average Air Force Fitness Test scores, to the men. There were five women that took part in this study, all of whom had scored excellent (>90) on the Air Force Fitness test. Three of these women had scored perfect 100 points out of 100. Women are physiologically different from men, and the average woman has a lower percentage of muscle mass compared to an average man. With many of the combat fitness events requiring strength, the question arose as to whether there was an honestly significant difference (HSD) between the combat capability of women and men. The Tukey-Kramer HSD analysis was selected to perform this test, but it was found that the requirement for equal variances of the two groups (which were far different in both population and variance) was not met. Therefore, a non-parametric comparison of medians analysis was the alternative, utilizing the Wilcoxon/Kruskal-Wallis Tests. These tests confirm that the medians between men and women are in fact significantly different, and the difference in the medians is 501.064 points out of 1200. Figure 25 shows the results of these tests, which had a p-value of 0.0003 for both the 2-sample test (normal approximation) and the 1-way test (chi^2 approximation).

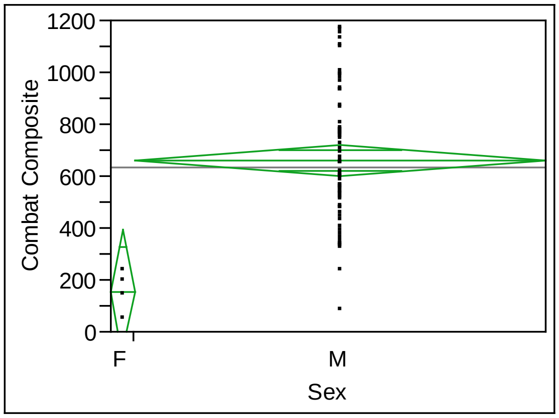

Figure 25. Non-Parametric Analyses of Combat Composite by Sex

A second use of the non-parametric analysis was done to determine if there was a "red flag" that could be raised if a subject was unable to pass the fireman's carry portion of the MANUF. Despite only being one event out of nine used for the Combat Composite, the question arose as to whether those who failed that portion of the MANUF were significantly less likely to perform overall on the Combat Composite, and thus have significantly different median values. Non-parametric analysis was performed on the group of subjects who failed the fireman's carry portion of the MANUF and compared to the group of those who passed that event. The results, like the previous analysis, show that the medians are indeed significantly different. Since failing the MANUF results in 0 points out of 200 for that event, and the average subject receives 100 points out of 200 for that event (50 percentile in stratification), the expected difference in medians should have been 100. However, the true difference in the medians is significantly higher at 354.483 points out of 1200. The p-values for both the two-sample test and the one-way test were 0.0002. This analysis is shown in Figure 26.

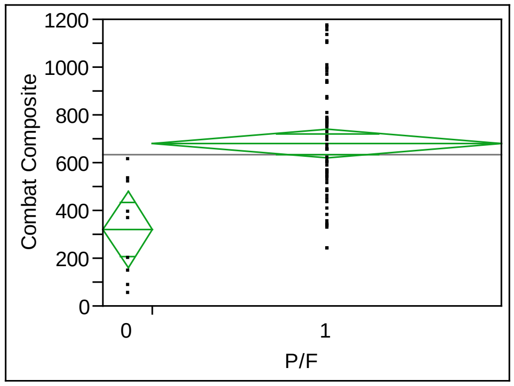

Figure 26. Non-Parametric Analyses of Combat Composite by MANUF Pass/Fail

Chi^2 Contingency Table Hypotheses Testing

Chi^2 contingency table hypothesis testing provides a way to evaluate statistical dependency between two variables. Two variables that are independent from each other should distribute relatively closely to an expected distribution (based on probability). When there is a dependency of the variables on each other, there is a deviation from this expected distribution; the further the deviation, the more strongly the dependency of the variables. In chi^2 hypothesis testing, the null hypothesis is that the variables are independent. Assuming a standard statistical α of 0.05, if the p-value is below 0.05 then the null hypothesis is rejected and it is concluded that the variables are dependent on each other. However, statistical dependency does not necessarily mean a causal relationship exists. The only validation requirement for a chi^2 contingency table hypothesis test is that the sample size be large enough for each expected value of each cell of the contingency table be five or higher.

There were five of these tests conducted during this analysis based on hypotheses made prior to data collection beginning. The first two were regarding subject "size" and the ability to pass the fireman's carry portion of the MANUF. "Size" was based on both

abdominal circumference as well as BMI. Of all the subjects, the median abdominal circumference measurement was 32.75. Since this measurement was done in ½” increments, and an especially large number of subjects had been recorded at a 33” waist, the best contingency table was built using the small waist versus large waste cutoff at 32.5”. For BMI, the subject median value was 25.15. This number was rounded down to 25 as the cutoff due to its proximity as well as the fact that a BMI of 25 is the cutoff that the Air Force currently uses to give maximum points on the abdominal circumference portion of the Air Force fitness test. The hypothesis was that the smaller sized subjects (those with abdominal circumference under 32.5” and/or BMI values under 25) would be far more likely to fail the fireman’s carry portion of the MANUF, and thus show a dependency of the variables in the analysis. The final hypothesis was that those who had BMI values under 25 would have more low-end Combat Composite scores (scores under 300 out of 1200) than those with BMI values over 25.

1) Waist above or below 32.5” vs. MANUF Passing or Failing. Table 19 shows this contingency table. The results were a p-value of 0.0052129 which equates to a variable dependency.

Table 19. Contingency Table Test: Waist of 32.5" vs. MANUF Completion

MANUF	Waist <=32.5"	Waist >32.5"	
Passed	30	36	66
Failed	10	1	11
	40	37	77

2) BMI above or below 25 vs. MANUF Passing or Failing. Table 20 shows this contingency table. The results were a p-value of 0.0015226 which equates to a variable dependency.

Table 20. Contingency Table Test: BMI of 25 vs. MANUF Completion

MANUF	BMI <=25	BMI >25	
Passed	26	40	66
Failed	10	1	11
	36	41	77

The third test was also based on the BMI cutoff of 25 and the ability to improve or decline in peer stratification from the Air Force fitness test to the Combat Composite. The hypothesis was that those with a BMI over 25 would improve in stratification and those under 25 would decline. A dependency of these variables in this analysis would confirm this hypothesis.

3) BMI above or below 25 vs. Improving or Declining in Stratification from Air Force Composite to the Combat Composite. Table 21 shows this contingency table. The results were a p-value of 3.1933×10^{-7} which equates to a variable dependency.

Table 21. Contingency Table Test: BMI of 25 vs. Stratification Change

	BMI <=25	BMI >25	
Delta <0	28	8	36
Delta >0	7	31	38
	35	39	74

The Air Force fitness test awards up to 30 points for the abdominal circumference portion of their fitness test. This fact alone can imply a strong correlation to smaller waists and higher Air Force fitness test stratifications. In order to avoid this bias, an adjusted Air Force fitness test score and stratification were created with the abdominal circumference portion excluded. The new maximum points were 70 (50 for the 1.5-mile run, 10 for the pushups, and 10 for the sit-ups). The fourth test was to see if those with a

BMI over 25 would improve in the stratification change from the adjusted Air Force fitness test to the Combat Composite, and those under 25 would decline. A dependency of these variables in this analysis would confirm this hypothesis.

4) BMI above or below 25 vs. Improving or Declining in Stratification from Adjusted Air Force Composite (Abdominal Circumference/BMI points removed; test is only 1.5-mile run, pushups, and sit-ups out of 70 instead of 100 points) to the Combat Composite. Table 22 shows this contingency table. The results were a p-value of 0.0058568 which equates to a variable dependency.

Table 22. Contingency Table Test: BMI of 25 vs. Adjusted Stratification Change

	BMI <=25	BMI >25	
Delta <0	20	10	30
Delta >0	15	29	44
	35	39	74

The final contingency test was selected to see if those scoring in the arbitrarily selected "poor" score range of less than 300 (out of 1200 possible on the Combat Composite) tended to have lower body mass indices. Unfortunately, with only seven total data points scoring less than 300 points on the Combat Composite, it was not possible to get expected values of five or higher for the two cells in the less than 300 points category. Despite the fact that the validity of the test is in danger if this requirement is not met, six of the seven subjects in the less than 300 points range were under a BMI of 25 (and interestingly, five of those six had a BMI under 23), resulting in a p-value of 0.0323936. Although this contingency test cannot be proven valid, it still has implications for showing that if there were more data and this trend continued, the hypothesis would be met and the test would be valid.

5) BMI above or below 25 vs. above or below 300 points out of 1200 on the Combat Composite. Table 23 shows this contingency table. The results were a p-value of 0.0323936 which equates to a variable dependency, although this test does not pass the requirement for all expected values of the cells to be above five.

Table 23. Contingency Table Test: BMI of 25 vs. Combat Composite of 300

	Combat Composite Points		
BMI	<300	>300	
>25	1	38	39
<25	6	29	35
	7	67	74

All five of the contingency table chi^2 hypothesis tests had low enough p-values to reject the null hypotheses that stated the variables were independent, although the fifth test may be questioned due to the non-validity of the test. All pre-conceived hypotheses were supported. The p-values of the five tests were, respectively: 0.0052129, 0.0015226, $3.1933x10^{-7}$, 0.0058568, and 0.0323936.

IV. Discussion/Conclusions

Chapter Overview

This chapter presents the author's opinion that is a culmination of the research presented throughout the previous chapters. The chapter begins with recommendations to Air Force leadership and a general discussion. Following these, there will be a detailed review and discussion of all of the events from the Marine CFT, the Army PRT, and the Air Force PFT. Following the discussion of the events will be a more in-depth look at a few of the key findings from the study. Lastly, the chapter will include a detailed description of the sources of study limitations and recommendations for future related research.

Suggestions to Air Force Leadership

First and foremost, utilizing a proxy for combat capability in future updates to Air Force fitness testing is most likely a wise decision. This research found that models as presented in this study offer excellent predictability of the Combat Composite proxy, although diminishing returns limits the feasibility of going beyond the two (1/2-mile run and 30-lb. lifts) or three event (1/2-mile run, 30-lb. lifts, Army pushups) best models. Whatever Airman combat capability proxy the leadership decides on should be considered for use in either a hybrid or combat-oriented fitness test in the future.

The current Air Force physical fitness test is a measure of general fitness as it was designed, but the time may be ideal for an update to this test. The Air Force has had over 15 fitness policy changes in its short existence, generally prompted by poor performance or some sort of research study findings. Air Force leadership is showing a willingness to

accept policy and training changes that are more contingency-focused (as evidenced by the recent addition of 'Beast' to the Air Force basic training). In-lieu-of (ILO)/Joint Expeditionary Taskings (JETs) are increasing and more and more Airmen are finding themselves in combat situations. Currently, many Air Force PT leaders are calling for tougher tests, tests more often, rescaled waist measurements to account for height, and the incorporation of exercises that mimic the stresses of combat. Sister-services, particularly the Marines with their implementation of their new CFT, are leading the charge in the investigation of the more robust type of combat-oriented fitness tests, which can therefore offer the Air Force many lessons learned as well as best practices. These events all show that the Air Force is experiencing a paradigm shift towards a joint combat environment, is very dynamic and susceptible to fitness test changes, and now is as good a time as ever to implement these changes.

A common issue that many have with the current AFPFT is the abdominal circumference measurement and the BMI standards. This research shows that abdominal circumference may be a measure for general health but has no predictability in terms for combat capability. For this reason, Air Force leadership should consider these as medical requirements instead of fitness testing requirements. Additionally, BMI standards according to the World Health Organization are highly variable from time to time and country to country. The US National Institutes of Health did not even match the World Health Organization's standards until 1998 (this was when the BMI cutoff between normal and overweight was lowered from 27.8 to the current 25). As different cultures and different body types have different standards, so should different occupations such emergency responders and military members from the "normal" population.

BMI was found to actually have a positive estimate when predicting combat capability as defined in this study. This shows that higher BMIs (and not those with BMI values under 25 who get rewarded with maximum points on the AFPFT) predict higher Combat Composite scores. For this reason, it is important for military leadership to acknowledge that a low BMI may be even more of a negative characteristic than a very high BMI. If an abdominal circumference or a BMI measurement will remain in future Air Force testing (whether it be medical or fitness related), it should be noted that Airmen are not part of the normal population and that perhaps a bell-shaped standard should be created to encompass those with a lack of muscle mass and associated low BMI or abdominal circumferences.

Regardless of which exercises are selected on the next update to the AFPFT, it is recommended that leadership focus on improving stratifications on the events. The current scoring sheets based on age and sex have extremely easy to attain maximums with the only exception being the 1.5-mile run. Additionally, age was not found to be a significant predictor of combat capability, and by making the scoring easier for older Airmen it is essentially taking the pressure off them to maintain their level of fitness as they age. Maximums should be either removed (and base scoring on group performances and stratifications among peers), made significantly more difficult to achieve, or the time-limited events should be extended to better distribute the performance measures of the Airmen (i.e., 1.5 or 2 minute events instead of 1 minute events).

Lastly, the fireman's carry portion of the Marine CFT's MANUF event was where all 11 failures of the tests occurred. Although the MANUF itself was not particularly high in the predictability of combat capability, the fireman's carry is a critical

combat skill that all military members should have (particularly with the no man left behind policy). If in the position of convoy commander having to select members to be part of your truck on a combat mission, and the choice was between a very small-framed Airman and a very large and strong Airman, most would select the very large and strong Airman with little regard to their AFPFT scores (most likely the small-framed Airman has a higher AFPFT score). This is because larger and stronger people are more likely to be able to carry you out of danger if trouble should arise and you get wounded. The truth is that the fireman's carry is a very important skill that needs to be far more emphasized in future SABC classes (where it is currently taught). It is recommended to require all Airmen be able to demonstrate the required strength and technique necessary for a fireman's carry.

General Discussion

Little is known about whether general fitness predicts combat fitness, specifically because *combat* fitness has never been standardized and defined. In war, anything can happen, and the United States military prides itself on having well-trained leaders who can make decisions on their own which influence others, in potentially life-saving or life-taking ways. Due to this tremendous responsibility on its leaders, and the military's track record on ensuring that training in every category possible is offered to minimize mishaps, it certainly seems that making another change to the Air Force's physical fitness program may be a value-added activity.

Based on the literature review of what has been done in past history, what other nations do, what other services do, and what research that has been conducted in the field of physical fitness, the author believes that the Marines have taken an excellent first step

in raising the standards of fitness in its members to minimize combat risks. This is a very recent step and should be critically evaluated on its success by tracking scores, scoring criteria, as well as combat mishaps that could have been avoided due to increased physical capabilities on combat-necessary tasks. As the new test becomes commonplace for Marines, it would be interesting to note if there is an overall decrease in these combat mishaps.

With all the US military services evolving their traditional roles into more of the "warrior" mindset, and the understanding that it is no longer just the Army and the Marines who fire their weapons outside the safety of a secured military base, perhaps all services should ensure combat readiness instead of simply general fitness. In-lieu-of (ILO) deployment taskings, now known as Joint Expeditionary Taskings (JETs), are now commonplace for the Air Force and the Navy: backfilling into traditional Army roles and being given "Just-In-Time" (JIT) Combat Skills Training (CST) for several months just prior to departing for the Area of Responsibility (AOR). Ensuring that all military members are training in applicable combat-specific tasks and able to pass a test that certifies this, regardless of service, is a clear and firm response to the DoD Directive 1308.1 call that, "Service members must possess stamina and strength to perform, successfully, any potential mission", and that "…each service develop a quality fitness program that improves readiness and increases *combat* effectiveness of their personnel."

A general fitness test may ensure that health-risk factors remain low for personnel and ensure a certain level of attractiveness in their personnel in terms of establishing optimum body composition standards. Despite the fact that it is unlikely to benefit them significantly in a combat environment, general fitness tests that include a long-distance

run will also ensure a standard aerobic threshold is met as per the previously mentioned studies on recovery. However, assuming care is given to avoiding the appearance versus strength paradox, the military may benefit further from these general fitness tests if specific Occupational Classifications (OCCs) are scored on different standards based on strength categories or job-specific tasks. Also, including combat-required skills in the assessment or in its own separate assessment may reduce combat mishaps and improve personnel confidence in themselves and in those serving along-side them in the AOR. Deployed commanders must also ensure that personnel that are subjected to combat environments are consistently kept at a moderate level of physical exertion and are given at least 5 hours to sleep per day (Patton et al., 1989). There may also be an advantage to making physical fitness training gender-specific and perhaps make certain high-strength required OCCs be restricted to men only in order to minimize injuries (as in the Australian Army study mentioned in the literature review). Lastly, the Army BCT studies show that there may be an advantage for services to adjust their weekly group PT sessions to focus on combat readiness training rather than just practicing for events that would be found on their general fitness tests.

It is interesting to note that the United States military does a lot to ensure that avoidable injuries and accidents do not occur within their services. Even though a relatively low percentage of US service members commit suicide or commit physical or sexual assaults on people, the military requires supervisors to set aside duty time for annual awareness training for these items for all military personnel. The military validates these expenses in terms of money/time developing the training and sacrificing man-hours of duty time due to training because they could stop future mishaps from

happening and thus save lives. It is difficult to put a monetary value on "future lives saved" or "future incidents avoided." Unfortunately, there is currently no military requirement to track whether or not combat mishaps could have been avoided had a military member been more physically fit or capable of completing a task found only in combat environments. But it is likely that by adding a combat-skills specific assessment to the general fitness test (thus creating a hybrid test), or by requiring a separate combat fitness test in addition to a general fitness test, it is also possible to validate this time and expense in a similar way that the current leadership validates the other required awareness training.

Mission-Essential Combat Skills and the Current AFPFT

A masters' thesis by Army Major Frederick O'Donnell revealed eight common "mission-essential" skills necessary for combat: foot-marching, climbing, sprinting, crawling, carrying, digging, three-to-five-second rush, and running (O'Donnell, 2001). O'Donnell found that these skills reoccurred in many combat tasks and if time devoted to physical fitness was proportionate to the amount of each of six physical readiness components necessary to complete these combat skills, then the resulting program would maximize combat readiness. This proportion would be 20% for motor efficiency, 19% for muscular endurance, 18% for anaerobic endurance, 16% for muscular strength, 13% for flexibility, and 12% for aerobic endurance (O'Donnell, 2001). The current Air Force physical fitness test currently awards 50% of its points for a 1.5-mile run which is mostly a measure of aerobic endurance, the least necessary of the six categories required in combat. In fact, sprinting and rushing as common combat tasks identified by O'Donnell emphasize the added value of short-distance runs such as the Army PRT's shuttle run or

the Marine CFT's 1/2-mile run, versus the current 1.5-mile run. Only 20% of the Air Force PFT points are for the pushups and the sit-ups, which are the only muscular and anaerobic endurance measures on the current test.

A Review of the Events of the Three Services' Fitness Tests

Evaluation and Discussion Procedures

This subchapter reviews the different events of the Marine CFT, the Army PRT, and the Air Force PFT in regards to their predictability and other significant reasons for whether or not to utilize that particular event in future fitness test batteries. The most important item to consider is the event's combat predictability as well as superiority over other events designed to test the same set of combat skills. Without ensuring superiority of events over others, a test battery could have significant multi-collinearity and redundancy, thus lowering the efficiency of the sequence of events in the battery. Second, events are briefly discussed in terms of their complexity in terms equipment needed, time required to set up, spotters necessary for scoring the event, and/or explanations necessary to test takers. Third, the performance measures of the events are evaluated on the ease of collection and the subjectivity of those counting proper repetitions or recording distances. Fourth, potential safety issues of each event are briefly discussed. Fifth, suggestions are presented for modifications or improvements to the events in order to: 1) increase the range of performance measures for a better stratification and likely an improvement in combat predictability, 2) to simplify the event, 3) to minimize subjectivity of the performance measure, or 4) to decrease potential safety issues foreseen with the event. Lastly, descriptions are presented of the reasoning behind any changes incorporated between the testing procedures of the events in this research

study and the way they were intended and presented by the Marines or the Army in their respective manuals and/or training instructions.

The Standing Long Jump

The Army PRT's standing long jump was a moderately-predictive event (adj R^2 = 0.3672) but had several problems. The first is that those who used their arms to assist in propelling the body forward, and those who timed the application of leg muscle force optimally ended up with significantly longer jumps. These two performance enhancement strategies are very simple to master with minimal practice. Within each group of volunteer subjects, those attempting this event after a few people had already gone were noticed asking those who had already gone "what they had done." It created an advantage for those going at the end of each testing group.

Secondly, this event required subjective scoring. The administrator and/or the spotter would record what they felt was the proper distance jumped simply on visual inspection. Often the subject jumping would land several inches, if not feet, away from the measuring tape, creating difficulty in achieving an accurate visual measure. On several instances, there was disparity of two or more inches between what the test administrator's distance estimate was when compared to another spotter's, which created difficulty in the resulting "compromise" to record the subject's jump distance. Lastly, in an attempt to minimize equipment necessary for a future fitness test, this event would likely be ruled out because it required two cones (marking the starting position), painter's tape (for holding down the measuring tape yet allowing for an easy removal from the gym floor), and a measuring tape. For these reasons, and the fact that it was only

moderately predictive, the author feels that a future combat-oriented fitness test should not include this event.

The Power Squat

The Army PRT's power squat, besides the Air Force PFT's abdominal circumference measure, was the least predictive of all the events (adj $R^2 = 0.1577$). That fact alone should be enough to eliminate it from contention to be on a future fitness test battery of events. However, this event also has other negative connotations. The first problem was that this event had a lot of requirements to watch for when spotting a test subject, and many of them were very subjective as to whether they were accomplished properly. For example, spotters had to ensure that test subjects had thighs parallel to the ground, heels stayed on the ground, arms extended parallel to the ground, up position had fully extended knees, etc. It was a lot to watch for and it is certain that some spotters were more lenient than others in counting the number of proper repetitions accomplished.

Lastly, there may be an issue regarding possible knee problems resulting from this event. The main concern is not with the event itself, but with possible repetitive squat training for test preparation. Knapik et al. (2002) presented this problem in their report on the Army PRT, stressing that high forces are placed on the knee during squatting and these forces might result in long-term damage to particular knee structures, or osteoarthritis, which is more likely to occur in those who engage in prolonged or repetitive squatting.

The Shuttle Run and the 1/2-Mile Run

The Army PRT's shuttle run was the most predictive of all events (adj R^2 = 0.6972), although it was very similar in terms of what capabilities it was testing to the 1/2-mile run event (adj R^2 = 0.6949). It is another event requiring spotters to ensure that subjects were touching the ground at each turn, and there were many cones necessary to measure out and place at the proper distances. The range of times were very minimal (only 12 seconds between the bottom 10% and the top 10%), and so a small mistake in running such as a slip or a failure to touch the line on a turn could result in a loss of several seconds which would equate to also losing many points.

In comparison, the 1/2-mile run (adj R^2 = 0.6949) had no cones necessary, no spotting necessary, no complicated abrupt changes in direction or leaning down to touch a line which could result in a significant time loss if done improperly, and 51.8 seconds separating the bottom 10% to the top 10%. It is a short enough run that almost forces test subjects to sprint the entire time. With it essentially being just a sprint, it is testing the same anaerobic bursts as the shuttle run, but with less complexity overall. For these reasons, the 1/2-mile run and not the shuttle run should certainly be an event on a future fitness battery.

The Army and Air Force Pushups

Pushups (Army PRT adj R^2 = 0.5277, Air Force PFT adj R^2 = 0.4946) were highly predictive and required no equipment to perform. The Army pushup event was the same as the Air Force pushup event except that there were no maximum or minimum passing values. Removing those "milestones" slightly improved its predictability. The Army PRT actually calls for this event to have "no resting", even in the up position.

Trial testing by Knapik et al. (2002) showed that this resulted in issues such as having administrators having to tell people to stop resting, subjects having to “unlearn” the old way of doing pushups (allowing for a rest in the up position), subject disappointment with performance, and a smaller range of scores (Knapik et al., 2002). Due to these issues, the pushups performed were done the “normal” way, where resting was allowed in the up position. With the pushups done this way, it is a very good event except that even without the milestones, one minute may not be enough time to allow a significant separation of the top 50% of subjects. Most of the subjects that failed to do repetitions all the way to the end of the 60 seconds only stopped in the last 10-15 seconds. Many subjects that did go all 60 seconds would have likely failed to keep going had there been just 10-15 more seconds available. For that reason, it is the author’s suggestion to improve on this event even further by making the event either 90 seconds or a full two minutes.

Lastly, subjective spotting may be an issue with pushups when it is questionable as to the subject having gone down low enough or having gone up high enough during each repetition. In some military locations, spotters make a fist and place it on the ground under the testing subject’s chest (although this typically requires women to spot for other women), which at least confirms the testing subject was going all the way down before going back to the up position. This is a possible recommendation to be made into policy for future fitness tests that include a pushup event.

The Distance (1/2-Mile, 1-Mile, and the 1.5-Mile) Runs

The Army PRT’s 1-mile run was a very simple event that was highly predictive (adj R^2 = 0.4751), but not as predictive as the Air Force PFT’s 1.5-mile run (adj R^2 =

0.5263) or the Marine CFT's 1/2-mile run (adj $R^2 = 0.6949$). This is likely due to the fact that fatigue had already become very evident on the 1-mile run because the event was after four other events (comparatively, the 1/2-mile event is first on the Marine CFT the 1.5-mile run is the 3rd event on the AFPFT). Predictability would likely increase for this event to a value greater than the 1.5-mile run if it were accomplished prior to this fatigue setting in (based on the assumption that the longer the distance run the less predictability).

The best of the distance runs in terms of predictability was by far the 1/2-mile run, which was the first event in its battery. This may have implications on future fitness tests in that perhaps it is best to put the distance run first. All three run distances are valuable additions to a future fitness test, although it would seem redundant to have something like the 1/2-mile run as an event on a battery that also includes a shuttle run. Likewise, it may be considered strange to have multiple distance runs on the same battery (the 1/2-mile and the 1-mile, the 1/2-mile and the 1.5-mile, or the 1-mile and the 1.5-mile). For this reason, the distance run selected for addition to a future fitness test may simply be based off of the order the events are in, what other events are in the battery, or perhaps how much change the service is willing to endure for the sake of added predictability. For example, the current Air Force PFT run is 1.5-miles, so perhaps leadership would want to minimize the test changes and choose not to change that event or to change it to 1-mile instead of the biggest change of making it into a 1/2-mile run.

Note that it was mentioned that the 1-mile run was fifth out of six events on the Army PRT. However, the Draft FM 3-25.20 called for the event order to be slightly different than what was done in this research study: long jump, squats, heel hooks, shuttle

run, pushups, and then the 1-mile run. This change was because the heel hook was the lone outdoor event and so testing was far more efficient in the cold weather when it was only necessary to allow "changing" time once during the battery.

The Heel Hook

The Army PRT's heel hook event was highly predictive (adj R^2 = 0.4667), but perhaps the most obvious choice of events to remove from a future fitness test battery simply due to safety issues and awkwardness of acquiring mechanisms for administering it. A heel hook done properly requires swinging the feet up over an elevated bar. Due to subjects having a wide range of heights, it was very difficult for the especially short or especially tall subjects to attempt heel hooks unless bars of various heights are all available, and that the bars are sufficiently long enough. Since there were no suitable pull up bars available (not long enough or too close to a wall), the author was forced into building his own heel hook device for placement outdoors. The fact that it was an outdoor device required pressure treated lumber and galvanized hardware and bar, which was rather expensive and time consuming to build and transport. For this reason, only one heel hook device was built at 6'-10" in height (of the 1" diameter bar) and 5' wide. Shorter subjects were aided in reaching the bar with a wooden step.

The heel hook statistics described in the study by Knapik et al. (2002) listed extremely low means (mean of 7, standard deviation of 5 for men; mean of 1, standard deviation of 2 for women), and that 9% of men and 74% of women could not perform a single heel hook (Knapik et al., 2002). That study required those performing the heel hook to select one of many bars positioned at multiple heights, and to not allow their feet to touch the ground during any of the repetitions. Since it was preferred to have a wider

range of scores for better stratifications (and for making a “passing” test standard), and because it was not feasible to make many different devices of differing heights, it was decided to allow subjects to touch their feet down between repetitions so long as their hands stayed on the bar. This had the effect of a larger range of scores (0 to 31 as compared to 0 to 20), a much higher mean (about 20 as compared to less than 6), and a less likely chance of a safety incident from someone falling from the bar (since they could be in standing position between repetitions versus hanging the entire time). Despite this advantage over the no-feet-touching policy, some subjects would almost jump towards the bar to help them achieve their next repetition. This became even more evident as the event time neared the end (and fatigue set in), or the subject was especially struggling. This created yet another subjective measure in terms of whether or not to count certain repetitions that appeared to be heavily aided by jumping or bouncing off the ground.

The last big issue with the heel hook was the fact that there was much potential for serious head or spinal injuries from falling from the bar. Spotters are present, but if they were not strong enough to catch a falling subject, or were not paying attention, a serious injury could occur. The spotters themselves are risking injury just standing so close to the device, since testing subjects often swung their legs at a rapid speed and may have struck a spotter accidentally. For the awkwardness, subjective nature, and certainly the safety issues, this event should not be considered for future fitness testing events.

The 30-lb. Lift

The Marine CFT’s 30-lb. lift was a highly-predictive event (adj $R^2 = 0.4891$) that effectively measured upper body, arms, and shoulders strength and endurance. It

required just a single 30-lb. dumbbell (although the Marines use actual ammunition crates) per subject testing. Safety may be considered an issue since the weight is lifted above the head and so dropping it could result in a potentially serious head or even foot injury if the spotters are unable to notice a slipping dumbbell. However, this event was selected by the JMP® regression software in all models (from 2-event all the way to 5-event models), likely due to its non-similarity to any other highly-predictive events. Therefore, it is the author's recommendation to include this event in future fitness testing batteries, but perhaps modified slightly to improve safety. It may be advantageous to do this event sitting down (better simulating the resupplying of ammunition while inside of a vehicle), which could reduce the distance the dumbbell could fall if slipped out of a subject's hands while raising to the top position. Another idea would be to make it a single-arm lift (although subjects can switch which arm is doing the lifting between repetitions), so that the dumbbell is gripped in the center as it is designed versus having one hand under each side of the dumbbell and doing a double-arm lift (which would be more likely to result in a falling dumbbell). If this single-arm dumbbell lift is implemented, it may be feasible to reduce the weight to less than 30-lbs., which is also likely to decrease serious injuries. Lastly, perhaps having a second spotter per testing individual would improve safety because there can be someone watching from either side of the subject.

The Maneuver-Under-Fire (MANUF) Drill

The Marine CFT's MANUF was moderately-predictive (adj R^2 = 0.3146), although it was the most difficult event to record data from since there were so many failures, and the only failure point (lifting the dummy to a fireman's carry) was only

partially (usually only one to two minutes) through the event. If 10 minutes had passed and the subject had not yet accomplished the dummy lift, time was called. If the dummy lift was accomplished before the 10 minute point, the subject had until 15 minutes to finish the event before time was called. The slowest completion time of the event was 14:55, so it was decided to count failures of the event as 15:00 so that the variable remained continuous. However, this created a point mass at 15 minutes due to the failures, effectively making the stratification of this event very difficult, and likely lowering its predictability.

The MANUF done in this study was different than the MANUF done by the Marines. The total distance traveled is the same, but several major differences exist: 1) the fireman’s carry is with a dummy instead of a live person within 10 pounds of the subject’s weight, 2) 30-lb. dumbbells are carried instead of ammunition crates, and 3) the course is broken down into 12x25-yard simpler legs instead of 3x100-yard legs with many different maneuvers required within each leg. The first change was simply due to group size and safety. The second change was due to non-availability of ammunition crates. The third change was due to constraints on the length of flat ground near the fitness center, increased simplicity in setting up the shorter course, and ease in explaining the procedure to the subjects. Converting to the 12x25-yard simple legs may be a smart change for the Marines to consider.

The MANUF was a very complicated event and many subjects needed constant guidance as to what they would be doing for the up-coming leg. In one case, it resulted in an injury when a subject dropped the dummy on the back of his ankle. Several subjects complained of back pain when attempting to lift the dummy. The simulated

grenade throw turned out to be a non-value added activity and was basically a coin flip as to if the person was going to hit the target or not. It was a very complex event to set-up and administer and very strenuous for the subjects, and for only a modest level of predictability. It is the author's recommendation that this event not be used in future fitness test batteries unless the fireman's carry portion is eliminated or made significantly easier as to not make the variable non-continuous in scoring distribution.

However, the MANUF event did lead us to some very interesting analysis findings. Dependency was found between waist sizes (being above 32.5") or BMI (being above 25) and the ability to pass this event (or to complete the dummy lift). This is discussed further later in this chapter under the subheading "Fireman's Carry."

The Abdominal Circumference Measurement

The Air Force PFT's Abdominal Circumference measurement was found to be non-predictive (adj $R^2 = -0.0126$). However, dependency exists with it and being able to do the fireman's carry (those with a waist of 32.5" or less were not as capable at completing it as those with larger waists), according to the chi^2 contingency table hypothesis test (p-value = 0.00152). For this reason, this measurement as it is currently utilized is in fact hurting the Air Force's ability to ensure combat capability. Instead of penalizing those with larger waists via point deductions, the Air Force should consider either removing these measurements altogether or else require those with smaller waists to ensure that they are in fact strong enough to carry out normal combat tasks.

According to research by Swiderski (2005), it was found that even if the goal is to focus on general fitness (and both the reduction of future health care costs and the improvement of the Air Force's professional image), the abdominal circumference

measurement is not as valuable as a waist vs. height scaled measurement. This is similar to BMI (weight in pounds multiplied by 703, divided by height in inches squared), but not the same. Additionally, this measurement requires male and female trained personnel to "tape" the testing individuals, which requires time, effort, and a very subjective tape measurement.

According to Fiscal Year 1994-1999 data, only about 10% of enlisted and 20% of officer Air Force members stay on active duty for over 20 years (Warner, 2006). Additionally, Castro and Adler (1999) projected an average military deployment rate of once every 18 months, which equates to several deployments before a first term enlisted member's commitment or a new officer's obligation time is completed. Therefore, an abdominal circumference measurement designed to measure general fitness (in order to control health care costs in the distant future for the few that stay in that long), appears to be a much less valuable measurement than a fitness event more designed to better prepare personnel for a combat situation (which is more likely to occur, even if the personnel separates from the military at their first opportunity). For this reason, it is the author's recommendation to either: 1) include the abdominal circumference as part of the annual medical check-up instead of within the realm of fitness testing, 2) to greatly reduce weighting of it on a fitness battery, 3) to make it a bell-shaped scoring curve and include point deductions for small waist measurements as well as large, or 4) to eliminate the measure altogether.

The Sit-Up

Sit-ups were a moderately-predictive event within the AFPFT (adj $R^2 = 0.4082$). They are a simple and safe exercise, although they typically require both matting to lay

on and spotters who may be slightly subjective in their proper counting of repetitions and in their discretion of whether or not the test-taker was going all the way down (shoulder blades touching the ground) or all the way up (an elbow must touch close to the knee). Additionally, this event did not appear very valuable when included in the different models. For this reason, it is the author's recommendation to eliminate this event from future fitness testing events to make room for more highly-predictive events. However, like the Air Force pushups (with a maximum), it may be possible to increase the predictability of this event by eliminating maximums and/or increasing the test duration to 90 seconds or two minutes, as was the recommendation for the pushups.

JMP® Model Analyses-Selected Events

Overall event selections based on the JMP® analyses led to the two event model including the 1/2-mile run and 30-lb. lifts (adj R^2 = 0.8852 post exclusions). This test would be simple, highly efficient, and highly predictive. It would only require a track to run on and dumbbells for the lifts, although it may be advantageous to modify the 30-lb. lifts to minimize the possible safety issues with that event. The three event model (adj R^2 = 0.9028 post exclusions) added in the Army pushups event to slightly improve the predictability, which is another short and simple event that does not require equipment and it is not a significant change from what Airmen already do for the fitness test. Both tests are shorter in duration than the current AFPFT, and would be a simple adjustment since two of the three performance measures should be very familiar to them (the run and the pushups).

Other Findings from the Analysis

Men's Performance vs. Women's Performance

Another finding that came of the non-parametric testing showed a great disparity between women's performance and men's performance. Although there were only five female test subjects, their variance in terms of overall combat composite was far below expected for a randomly selected group of only five subjects. In fact, the range of their combat composite scores was limited to just 182 (from a low of 49 to a high of 231). This implies that with several additional female test subjects the median score would not likely be significantly altered for their group. Additionally, the group of five females had a significantly higher mean AFPFT score (96.8) when compared to the men (90.1), so this small sample of women may actually be an "overly fit" selection of women and not necessarily a good representation of the women in the Air Force (additional support of this can be found in the "Very Fit and Eager to Volunteer" subsection of the "Items of Impact to the Research Study" section of this chapter). The difference according to ANOVA in terms of combat composite between the men and the women was over 500 points, where the mean men's score is 661.162 points, and the women's mean score is 153.75 points. This is an extremely large disparity, which in the author's opinion warrants further considerations for women in high-strength-required career fields or in combat situations.

The Body Mass Index vs. Combat Capability

BMI is another critical factor that was analyzed further due to several hypotheses such as subjects with lower BMI's typically having less muscle mass and therefore less

capability to perform on these combat-oriented events. Although the "expected value of five" rule was not met for that particular chi^2 contingency table test, there was evidence of this by seeing that "poor" scores (<300) appeared to have a dependency on a low BMI (<25). This low BMI (<25) was also found to have a dependency on not being able to complete the fireman's carry portion of the MANUF as well as a dependency on volunteer stratifications decreasing between the AFPFT and the combat composite.

Initially, this second dependency was thought to be due to the high weighting of the non-predictive abdominal circumference measurement and the maximum 30 points received on that portion of the test for those with a BMI below 25. However, this dependency continued even after taking the abdominal circumference points out of the initial AFPFT stratification (thus leaving the AFPFT stratification based out of 70 points: 10 for pushups, 10 for sit-ups, and 50 for the 1.5-mile run). This implies that it is not simply the non-predictive points for abdominal circumference throwing off the AFPFT stratification. This appears to support the initial hypotheses regarding lower muscle mass and therefore lower combat capability in those Airmen with lower BMI (and therefore, smaller abdominal circumferences).

The Importance of the Fireman's Carry

The MANUF event within the Marine CFT was by far the most trying event out of all three physical fitness tests. It involved many aspects of simulated combat, including: simulated grenade throwing, sprinting and zigzagging through and around cones, carrying two 30-lb. simulated ammo crates, high-crawling, underarm carrying a casualty, and fireman's carrying a casualty. Eleven subjects (7 men and 4 women) could not lift the adult-sized dummy into the fireman's carry, accounting for a 14.103% overall

failure rate (9.589% men and 80% women), despite a mean AFPFT score of an "excellent" 90.51 (90.1 men and 96.8 women) for all subjects.

The most modern flak vests worn in the AOR today range from 16.4 pounds using the Interceptor system with enhanced/small arms protective inserts (E-/SAPI), 24.0 pounds with the Ranger Body Armor (RBA), or 25.1 pounds for the Personal Armor System for Ground Troops (PASGT). Next generation protective gear, such as the XSAPI, is currently ½ pound heavier per plate than the ESAPI. Protective gear is continually getting thicker and heavier in order to defeat new and more potent bullets finding their way onto the battlefield. Since the dummy in the MANUF did not have a flak vest on but a typical person deployed to a combat environment would have, it is reasonable to assume that this dummy is simulating a person that is actually somewhere between 16.4 and 25.1 pounds less than the 180 pound weight of the adult-sized dummy.

Additionally, due to the age of the dummy and the fact that it had been outside for so long prior to this research, rust had taken its toll on the hardware holding it's joints together, and one of the dummy's lower limbs (left leg from the knee down) broke off before the data collection phase even began. This limb was left off and was described to the volunteers as "the reason why this dummy is a casualty and needs to be recovered." The lost portion of the limb weighed ten pounds, so the actual weight of the dummy was only 170 pounds, and so the weight of the simulated casualty wearing an ammo vest is only between 144.9 and 153.6 pounds. Assuming casualties in combat typically carry one or more weapons, wear Kevlar helmets, possibly carry a backpack, wear boots, and have a tactical vest with numerous pieces of gear, this estimate might actually be closer to

somewhere between 120 and 145 pounds. This is around the average size of an adult woman in the military.

It is unfortunate that despite having a mean fitness score in the "excellent" (>90) category, over 14% of these volunteers could not accomplish a fireman's carry of a simulated average-sized woman in combat. This is worrisome considering members of the US military typically follow the "leave no one behind" policy and will risk their lives for the recovery of a casualty. Unfortunately, members of the US Air Force are not required to perform the fireman's carry during any mandatory training or fitness activities, and as the results shown, many lack the strength and/or technique to properly administer it.

For someone in a combat situation, it is critical to have the ability to perform the fireman's carry for several reasons. Adults can usually carry smaller women and children in their arms because they are generally lighter than adult men or adolescent boys. But if an adult is in a situation in which they have to carry an adult man or a larger woman, the fireman's carry allows them to rely on the strength of their shoulders, back, and legs to transport the subject instead of relying on the strength of their arms. Additionally, a fireman's carry keeps the subject's torso fairly level, which helps prevent further injuries. Lastly, when the subject's weight is evenly distributed over both shoulders, it is easier to carry them for a longer distance. All of these reasons make the fireman's carry a vital skill for all to possess before going to a combat environment.

One possible response would be to include the MANUF, or the fireman's portion of the MANUF, into future Air Force physical fitness testing. After all, the ability to pass this event was found to be highly predictive of combat capability utilizing analysis of

variance (ANOVA), as can be seen in the vast disparity of the mean Combat Composite of those who passed the test versus those who did not pass that event. However, the MANUF is the most complicated event out of all the events, requiring an obstacle course to be set up with cones, a mock-grenade, dumbbells or ammo crates, and of course, a simulated casualty. Adding this event would compromise the simplicity of the current AFPFT, and as the analysis shown, there are other ways to increase the predictability of the AFPFT without requiring the MANUF. Keeping that in mind, perhaps it is easier and more logical to simply require both the instruction *and* individual testing for completion of a fireman's carry during a different mandatory Air Force training requirement. Self-Aid and Buddy Care (SABC) seems to be the best destination for this new testing because it is already a mandatory annual training where instruction on the fireman's carry is currently covered. Typically the method of demonstrating the technique during the training is by asking for two volunteers, one to act as the casualty and one to act as the carrier. Perhaps instead of this method, in order to successfully pass the training, trainees must successfully demonstrate a fireman's carry over a specified distance (of either another trainee of similar weight or else by utilizing a dummy). This change in the SABC training would certainly require trainees to sign a Health Screening Questionnaire (HSQ) before the class.

Items of Impact to the Research Study

IRB Process Delays

The extremely long waiting period for the Institutional Review Board (IRB) process to be completed had a major impact on the ability to obtain volunteers for this study. The original research timeline following the IRB board approving the research

protocol in June was to run the data collection phase between July and September 2008, just before a majority of anticipated subjects took their October Air Force Fitness tests (minimizing the time period between all of the tests). There were many volunteers expressing interest following the IRB board approval, and it was simply a matter of waiting on the Judge Advocate and the Surgeon General's offices for the final go-ahead with testing. After several months of unanticipated delay and at least a dozen unanswered phone calls, messages, and e-mails, much of the volunteer base was gone. Many potential volunteers had lost interest, many were no longer represented by the same Unit Fitness Program Monitors (UFPMs) at the monthly Health and Wellness Center (HAWC) meetings and therefore no longer receiving the research updates from them, many had deployed or encountered a permanent change of station (PCS), and many were simply not as excited about taking the tests now that the spring and fall warmer weather was gone.

Considerations of an alternate thesis concept were underway when the go-ahead was finally received the last week of October. The average temperature was already starting to drop dramatically. As the temperature dropped, the average number of volunteers per testing session dropped even faster (there was a group of nine on 28 October and a group of ten on 3 November, but by December, the average group size was only down to between two and three). It was soon evident that there was a misconception about outdoor events on the two tests, and that people were not likely to volunteer due to fear of being uncomfortable testing outdoors for any time at all.

Both tests are actually largely indoor tests, with only one event outside for each. The one Army outdoor event is the Heel Hook, which is positioned next to the Wright-

Field Fitness Center's (WFFC) exterior wall to block the wind, only about 50 feet outside the main gym door at WFFC. It is a 60 second timed event, so if the walking to/from the gym door and the investigator's short safety demonstration of a proper heel hook is included, a volunteer may only be subjected to about two minutes outside.

The MANUF is the only event on the Marine test that is outside. To keep volunteers from being outside too long in cases of colder temperatures, it was recommended for volunteers pull up their vehicles to the parking lot which is adjacent to the MANUF testing location. The detailed description of the event and a question and answer period regarding the testing was done inside the gym before heading outside. The only demonstration that was done outside (requiring volunteers to stand outdoors) was a roughly two minute safety demonstration of a proper underarm drag and fireman’s carry of the dummy. Upon completion of the dummy demonstration, the only volunteer outside was the volunteer currently testing on that event. The non-testing volunteers in the group could sit in their vehicles to stay warm if it was cold out. The mean time for the MANUF event was about 5 minutes. The event was ended if a subject was unable to lift the dummy into fireman's carry position by the ten minute mark. The slowest completion time on the MANUF event was 14 minutes and 55 seconds (subject accomplished the lift of the dummy into the fireman’s carry at just under the ten minute limit, and took about five minutes to finish the event following the fireman’s carry lift).

After all time is added up, the average person is only outside for two minutes on the Army test, two minutes watching the demonstration of the dummy portion of the MANUF, and between 2.5 and 15 minutes taking the MANUF, for a total of between 6.5 minutes and 19 minutes. Even in extremely cold temperatures, this is minimal exposure

time. It was frustrating to see the number of volunteers plummet along with the temperature, and even more so when there was precipitation (usually snow) on the ground. Even more frustrating was when there were a large number of volunteers on the first of the two tests (typically the Army test), that were unable to come back, or decided to not come back for the second test. As the winter testing wore on, investigators began to hear more and more complaints about volunteers "not feeling well" or "were just getting over sickness" and did not want to over-exert their bodies. This was likely due to the typical increase in sicknesses throughout the winter/flu season. To ensure that collected data was from a collection of volunteers that were capable of giving their full efforts, and for safety reasons, volunteers were not permitted to continue testing if they mentioned anything other than being in perfect condition to test at their full abilities, in accordance with the Health Screening Questionnaire that volunteers were required to sign before testing.

Unfortunately, the recruitment, sickness, or non-return issues would not likely have occurred had the IRB process been anything less than inadequate. An IRB approval in June followed by a notice to proceed in July is adequate, and would have allowed for data collection throughout the remaining summer and fall warmer seasons. However, an IRB approval in June followed by a paperwork stack sitting in the Surgeon General's office awaiting a signature for over 50% of a nine month research timeline is not adequate whatsoever, and this had a major impact on the ability to get and sustain healthy and willing volunteers for this study. It is evident that besides the differentiation between exempted reviews, expedited reviews, and full reviews, the IRB process needs to take

into account the needs of shorter time-lined research proposals, as in a Masters student, versus the longer time-lined research proposals of Doctoral students or faculty research.

Very Fit and Eager to Volunteer

Another item that had effects on this study, albeit minor, was the fact that there were a lot more extremely fit personnel who were eagerly willing to volunteer than were not as fit. Much recruitment effort was put into combating this because it was a goal to get the sample data to have as close to a normal distribution as possible when scores were stratified against each other, ranging from a minimum passing score of 75 to a maximum score of 100. If this was the case, the mean score would be an 87.5, equally between the 75 and the 100. Upon completion of data collection, the minimum AFPFT score was a 75.6 (very close to the target), and the maximum was 100 (as expected). The mean score of the data ended up being 90.51, which is relatively close to the 87.5. This slightly higher mean is mostly due the fact that a score of 100 is actually a maximum and so there is a point mass at 100 for the few volunteers, if given the opportunity to score even higher, could do so. Additionally, this slightly higher mean may have been partially due to the investigators' inability to completely curb the fears of those with less fitness capability from volunteering.

A point was made during recruitment (following permission from unit commanders to present the research/volunteer opportunity to their PT groups) to emphasize that the goal was to get a large range of capabilities of volunteers – those with small waists, those with large waists, those with poor Air Force Physical Fitness Test (AFPFT) scores, those with excellent AFPFT scores, etc. As those who are typically deemed “less fit” may be concerned about looking even more non-capable next to

another volunteer in excellent shape (according to AFPFT standards), it was certainly a challenge to maintain a significant number of volunteers to balance out the scores on the normal curve. However, it was a challenge that was successfully combated, as is evident by looking at the stratification of scores of the volunteers on a normal curve.

No Practice or Knowledge of Events

Performance on the combat-oriented testing events would likely have been higher had the subjects had the opportunity to practice the events prior to the testing or if they had been given time to learn optimal performance strategies. However, since all of the subjects had no preparation and no chance of re-taking any events, there is no variable "preparedness" necessary for the analysis. Having zero preparation time simplified the analysis.

Varied Motivational Levels

Lastly, volunteers knew that the testing was experimental and not linked to their performance reports or fitness program track record, which can result in varied motivational levels among the subjects. This was initially combated during the recruitment phase when it was specifically mentioned that if the subjects were not willing to exert full effort then it was preferred that they not volunteer in the first place. Additionally, event means, and standards of deviation, were typically withheld from subjects who asked during the testing. This minimized the "milestones" for subjects to set as goals, so that similar point masses around those values would not likely occur as they typically do on the current Air Force PFT around repetitions corresponding with the maximum point values.

If the subject continually asked for this information and due to the rank or status of the volunteer it was not proper to withhold this information from them (i.e., administrator is rank of Captain and volunteer subject is rank of Colonel), then the administrator would estimate values if the requested information was regarding Marine CFT events. If the requested information was regarding the Army PRT events, the administrator would state information based on the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) Technical Report 12-HF-5738-02 entitled, "Administration and Safety Evaluation of a Proposed Army Physical Readiness Test" (2002), which includes detailed data for all six Army events (Knapik et al., 2002). There were no cases during the research study where a test administrator felt that a subject was providing poor data by not exerting themselves to their best ability, and so it is the author's belief that varying motivation's effect on the study was very minor.

Suggestions for Future Research

This research has barely scratched the surface in the evolving research fields of fitness, fitness testing for military services, and combat capability. There is certainly room for continuing research based on the methodology, models, conclusions, or discussions of this research. The following are a list of suggested future research topics:

1) Enhance or change the models by doing this process again with more data points, more women subjects, or a higher ratio of older to young subjects.
2) Utilizing the models' events to more easily analyze association of combat fitness to other items, such as medical/health issues.
3) Track combat mishaps caused by physical deficiencies and determine adequacy of current military fitness programs. Additionally, see if there is a difference in the

different services (test the hypothesis that the Marines have fewer percentages of incidents now that they have introduced the CFT into their fitness program).

4) Interview subjects with combat experience to build a current list of combat-necessary skills per AFSC in order to determine if typical Air Force unit PT sessions adequately prepare subjects for combat (similar to Army Major O'Donnell's study of light infantry).
5) Test subjects on the models' events in order to build scoring charts useful for the Air Force.

Appendices

Page

Appendix A. Research Protocol

A Comparison of the US Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests
F-WR-2008-0041-H

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Additionally, trained Unit Fitness Program Monitors (UFPMs) will be present for their unit's volunteers' testing days, acting as medical observers. USAF UFPMs are trained in Basic Life Support (CPR).

4. Facility/Contractor

No special facilities will be needed. The Area B base gymnasium (WFFC) will be sufficient. UFPMs typically already have established group physical training (PT) times/locations and the goal is to complete this research from volunteers whom will then be allowed to do this research and have it count as their group PT for that day. A Memorandum for Record (included as an additional attachment to this protocol) will be delivered to each participating unit's Commander (via the UFPM) requesting this allowance, and will be signed by the supporting commander and returned to an investigator prior to the scheduling of any testing.

5. Objective

The current Air Force fitness test is used to evaluate service-members' general health. However, it is unknown whether or not this test is a good predictor of *combat* fitness. If someone is deemed healthy by the current testing standards, does that necessarily deem them *combat* fit? Does very poor or very high performance on the general fitness test predict very poor or very high performance on a combat fitness test? How much influence does each event within the Air Force fitness test have on the predictability of combat fitness, and are there certain events that appear to be under or over influential? Are there better ways to weight the event scoring, or to add, subtract, or alter events in order to maximize the predictability of combat fitness? This research will be used to

compile multiple variable-dependent personnel stratifications from a sample population and compare them to similar stratifications of the same personnel whom will take these newly developed *combat* fitness tests. Regression, ANOVA, and contingency table hypothesis testing analysis will be performed on individual personnel's event scores in order to determine if statistical differences, if any, exist between the general health fitness test and the combat fitness tests, or if variations of the tests offer improved predictability of combat fitness. Results will determine what ramifications this research will have on the Air Force and its evolving mission.

6. Background

Combat of today is changing and the Air Force overseas mission is getting closer and closer to the Army and Marines role. Past wars typically involved airfields far from combat and rarely had instances of the airfield itself being attacked. Now we face common locations where our Airmen are deploying to where they are in close proximity to potential enemy forces that make them vulnerable to both direct and indirect attacks. Certain Air Force career groups are even augmenting the Army, and serving alongside them in long-term outside-the-wire deployment roles, called "In-Lieu-Of" (ILO) or Joint Expeditionary Taskings (JET). Both the Army and the Marines have questioned that a fitness program simply measuring general fitness may not be sufficient at maintaining or measuring combat readiness in their personnel. Both of these sister services are exploring additional or alternative tests to better measure *combat* fitness, or the ability to handle the stresses, strains, and sometimes urgent demands required in combat situations. The Marines have just this past year added a twice-a-year Combat Fitness Test (CFT), focusing on burst speed and anaerobic ability, which is now in its one-year trial testing phase. Since 2002, the Army has been considering changing their current 3-part Army Physical Fitness Test (APFT) to a 6-part Army Physical Readiness Test (APRT), which includes more events to better encompass combat ability in addition to general fitness. And according to the June 9th, 2008 Air Force Times main/cover story entitled, "Fix the Fitness Test Now," PT leaders in the Air Force are now starting to call for tougher tests, fairer waist measurements, *and* a combat fitness program. The goal of this research is to collect data that when analyzed can offer statistical evidence useful in gaining insight into this new paradigm shift towards combat fitness in the United States' military.

7. Impact

Results from this study will be used to determine what ramifications this research will have on the Air Force and its mission. Exploratory analysis of the different testing events could lead to numerous implications about our current test and/or the sister service combat fitness tests. If peer stratifications on the Air Force test as it is today end up closely relating to peer stratifications on the combat fitness tests, it can be concluded that there is a statistically significant correlation between general fitness and combat fitness, and that the Air Force current program should remain sufficient for our evolving combat mission. This outcome

would also imply that our sister services may be devoting unnecessary time and resources to these new combat fitness programs. On the other side of the spectrum we can determine that if the peer stratifications seem to have little correlation with each other, the Air Force fitness program may be in need of a fitness test overhaul and/or the addition of combat fitness events/tests to its current fitness program in order to better keep up with the evolving combat mission.

8. Experimental Plan

a. Equipment:

The testing will require either the use of the WFFC gymnasium. The APRT test requires a track to run on, an elevated bar perpendicular to the ground (i.e. pull up bar), and several cones for marking off distances. The extent of equipment needed for the CFT are a track to run on, several cones for marking obstacles to run around, two 30-pound dumbbells, a "mock casualty" dummy, and a simulated grenade.

b. Subjects:

The source of the subjects for this study will be active duty Air Force personnel currently age 18 or greater, whom have medical clearance to participate in USAF fitness testing. All potential subjects must complete and pass the Air Force Health Screening Questionnaire that the Air Force currently uses prior to allowing testing on the current Air Force fitness test, which is an attachment to this protocol. Self-reporting pregnant women will be excluded from the study. There will be no further compensation for subjects beyond their normal duty pay. According to the central limit theorem, there will be a minimum of 30 subjects required for significant statistical hypothesis testing to take place, although it is the goal of the investigators to test as many subjects as possible during the 4-month testing period because the more subjects tested the better statistical conclusions can be drawn from the data (stronger p-values leading to more certainty in our hypotheses tests). However, due to time constraints of this research, it is estimated that there will be approximately 100 subjects in this study.

Recruiting will occur as follows:
1) Get MFR to UFPM who gets CC signature authorizing his unit's potential participation.
2) At monthly UFPM meeting (or via scanner and e-mail), collect signed MFRs and respective unit group PT times and days, so that scheduling can begin.
3) Coordinate first day for an investigator to attend group PT, and first day to do testing with UPFMs.
4) At first day of attending group PT with unit: during stretching or prior to stretching (some units do announcements prior to stretching), make following announcement:

"Hello, I'm ____ and I'm here to let anyone who is interested know that I'm doing research on Air Force fitness testing versus fellow services' combat fitness tests. Your commander has allowed me to recruit from his/her unit, and if you participate, over two group PT days within the next three months, you will take the Army Physical Readiness Test and the Marine Combat Fitness Test in place of your normal group PT activities. You do not have to be a fitness expert, and we encourage all physical abilities to participate, as there is no passing or failing, and there will be absolutely no consequences to taking these tests. The screening for this testing is on par with screening for the normal Air Force PT test. The only other request is that participants print out a copy of their Air Force PT test scores from the Air Force portal and bring that with them on our first scheduled combat testing day (with their name replaced with a subject code comprised of the first letter of their last name followed by the last four numbers of their SSN), which is scheduled with your unit for _____. The second test will be scheduled at a later date at least one week later. Testing will be done at the Wright-Field Fitness Center in Area B. At this time I can field any questions you may have, or, if you prefer to leave me your name and e-mail address, I can contact you at a later time so we can discuss this research further. Health Screening Questionnaires and Informed Consent Forms outlining the testing are available for review if you would like. Thank you for your time."

4) Attend first combat testing day. Coordinate and schedule 2nd combat testing day.

5) Attend second combat testing day.

6) Data collection with unit completed.

c. Duration:

Data will be collected from October 2008 - January 2009. Each volunteer will be tested in two separate time periods, roughly one to two hours in duration each. Volunteers will be tested during their respective unit's normal group PT session, as coordinated between the UFPM and an investigator. The two testing periods will be a minimum of one week apart.

d. Description of experiment, data collection, and analysis:

The WPAFB Health and Wellness Center (HAWC) holds monthly UFPM meetings, which is where most of the test scheduling will be coordinated between the units and the investigators. An investigator will then attend a group PT session prior to the testing day in order to make a brief presentation to the unit personnel who may ultimately volunteer to be a test subject. Most units during group PT have an "announcements" or stretching period where this type of recruiting briefing would be appropriate. At the briefing, the investigators will inform potential subjects of the testing dates for their respective units.

Those unit members wishing to participate will simply show up at the time given during the investigator briefing. Potential subjects will read and sign the

Informed Consent Document, and complete the Health Screening Questionnaire prior to testing. The UFPMs will ask those who have volunteered to bring their Air Force Portal fitness print-outs to the testing site. The testing will be done over two separate testing days – one for each of the two combat fitness tests. The different tests will be composed of events that count either repetitions, time until completion in seconds, or distance in inches. These tests, events within the tests, and their measures of performance are recorded in the attached appendix. These quantitative values will be the data collected from each volunteer by using "spotters", stop-watches, and measuring tapes, respectively. The intention for testing is to break the volunteers into groups of two, so that when one is testing the other is "spotting", which means watching for safety issues as well as recording the performance measure for that event. The trained UFPM will first lead the volunteers in proper warm-up procedures to minimize risk of injury. There will also be demonstration of the proper technique in accomplishing each event of that day's test. There will also be a proper cool-down following the testing.

This collected data allows for stratifications among peer-groups which can be assigned by age, sex, career field, or other variables. Subjects will be asked (as requested in the Informed Consent Document) to bring their Air Force Portal fitness score print-outs, providing the critical Air Force fitness test event scores plus additional data including age, height, and weight, which will also be added as variables to the analysis. JMP® will be the program used to analyze this data by altering independent variables and tracking how the peer stratifications are altered among each peer group. Regression, Analysis of Variance (ANOVA), and contingency table hypothesis testing will be used to compare mean performance measures and overall performance for the different tests.

e. Safety monitoring:

Since testing will be done with volunteers in groups of two, the investigator can lead the testing and monitor for safety without being distracted by the data collection methods themselves. While one volunteer is testing, the other volunteer in that group will be spotting them for safety issues, while also collecting the data for the investigator. The volunteers testing on each scheduled testing day will be from the same unit, which has a trained UFPM who will also be available to help in any case where safety could be a concern.

f. Confidentiality protection:

Subjects will utilize easy-to-remember subject codes being comprised of the first letter of their last name followed by the last four digits of their SSN. This code will replace subject names on all documents (including the Air Force Portal print-out) in order to protect confidentiality. Any on-site test data collection sheets will use that subject code instead of that person's name.

9. Risk Analysis

Because this research involves physical activities and strenuous exercises, there are slight medical risks to the participants in this study. However, this is a test of active duty military personnel who typically have an established fitness program that requires multiple fitness sessions per week. A standard Air Force Health Screening Questionnaire will eliminate the most at-risk volunteers. All events to be tested will be properly demonstrated to help avoid potential injuries. All testing participants will be lead in proper warm-up and cool-down procedures. Nonetheless, physical fitness tests that include these types of (in some cases, unfamiliar) events could lead to injuries such as twisted ankles, sprains, bruises, lower back pain, abdominal cramps and pain, muscle fatigue, strains, exhaustion, nausea, headaches, or other reasonable injuries caused from elevated levels of stress on the body, both physically and psychologically. Due to these possibilities, a medical first aid kit will be on site at all testing locations, the UFPM will be on scene to act as an additional medical observer, and there will likely be a large number of personnel with current Self-Aide and Buddy Care (SABC) training. In any case of additional medical advice being required, the investigator on site may contact the research Medical Monitor, or in an emergency situation, can call for an ambulance or 911.

The nature of this research is non-controversial and would not cause any harm to the subject either personally or professionally. Data such as performance measures will be referenced with consent from the subject, and subject names will not be included in any reports.

The risk to gain ratio for this research has been minimized, and certain higher-difficulty test events have been altered to minimize risk for a volunteer. For example, the fireman's drag and carry within the Marine's CFT was designed to be using a live person as the casualty. But since Air Force personnel receive little training on a proper fireman's drag and/or carry, a standard adult-weight (180 pounds) dummy will be used as the casualty. Subjects will also receive instruction on the proper way to execute these "casualty" transport procedures. Additionally, due to the lower temperatures during the testing months at this location, volunteers may choose to wear combat boots/uniform as the tests originally called for, or if they prefer the Air Force PT uniform. These are limitations that are being injected into the research for the sole purpose of minimizing potential injuries during this testing.

10. References

See the Bibliography of the thesis related to this research study.

11. Attachments

a. Informed Consent Document
b. Health Screening Questionnaire
c. Descriptions of Tests, Events, and Performance Measures
d. Memorandum for Record for Commanders

Appendix B. Informed Consent Document

INFORMATION PROTECTED BY THE PRIVACY ACT OF 1974

Informed Consent Document
For
A Comparison of the US Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests

Air Force Institute of Technology (AFIT), Wright-Patterson AFB (WPAFB), Ohio

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Nature and purpose:

1. You have been offered the opportunity to participate in the research study entitled "*A Comparison of the US Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests*". Your participation will occur at Wright-Patterson AFB, at Wright-Field Fitness Center or the area directly outside of Wright-Field Fitness Center.

   The goal of the study is to be able to compare our current Air Force test with our sister service combat-focused tests, with the main goal in mind to see if general fitness is a good predictor of combat fitness. Statistical analysis will be used on the data in order to form conclusions that will be meaningful to the Air Force and/or its sister services.

   The time requirement for each volunteer subject is anticipated to be a total of two visits of approximately one to two hours each. At least 30 subjects will be enrolled in this study, although for aiding in statistical hypothesis testing the goal is to collect as much data as possible, and so there could be over 100 subjects. To be eligible for participation you must pass the same screening requirements which are used for the current annual Air Force PT test. You are still encouraged to participate even if you believe that you do not excel in physical aptitude.

You must also be willing to submit an Air Force Portal print-out of your past Air Force fitness records, or grant permission for your unit fitness program monitor (UFPM) to print-out your Portal records. This information will be used for research only, and names will not be included in any reports or documents. Names will be replaced with a subject code consisting of the first letter of your last name followed by the last four digits of your social security number in order to protect your privacy.

2. **Experimental procedures:** If you decide to participate, over two separate testing days (at least a week apart) you will be given two sister-service fitness tests designed to be more combat-fitness focused then general-fitness focused. There are no scoring standards for either test and there are no minimums or maximums. A participant may stop the testing at any time. Participants may wear the normal Air Force PT uniform or a combat uniform with combat boots (either the ABU or the BDU) and will be given a chance to change between indoor and outdoor events if desired.

   The APRT test involves 6 events, spaced out over a period of up to 2 hours maximum. After each event, you will get between 5-10 minutes of a break, where you can stretch, eat, drink, or use the bathroom. The first event is the standing long jump, where you are to squat down and then leap as far as you can from a set line. You are encouraged to swing your arms but to try to land balanced so that you won’t roll back onto your hands. You have two attempts to get the largest distance between the start line and your closest contact point with the ground. The second event is the squat, where you have 1 minute to perform as many precise squats as possible. You will squat down so that your thighs and arms are parallel with the ground with your back straight, and then you will return back to a standing position. The third event is a 300 yard shuttle run consisting of 25 yard increments, touching the line and changing directions until the 300 yards is completed. You may run through the finish line instead of touching the line at the end of the last 25 yard sprint. The fourth event is one minute of pushups done just like the current Air Force fitness test. The fifth event is a one mile run. Although walking is authorized, it is not encouraged. The goal is to complete one mile is the shortest time possible. The sixth and final event is the heel hook, where you grip your hands on either side of an elevated bar with your arms extended. You then swing your legs up over either side of the bar and connect them in a heel hook. You will have spotters protecting you from falling while you repeat this as many times as you can in one minute.

   On a separate testing day you will take the Marine CFT. This test has three events, with sufficient rest time between events to allow for recovery, food and/or drink, or a restroom break. The first event is the 880 yard run (half-mile), known as Maneuver to Contact (MTC). Although walking is authorized, it is not encouraged. The goal is to complete the 1/2 mile is the shortest time possible. The second event is the 30 pound lift, known as the Ammunition-Can Lift (AL), where you lift a weight from chest height to above the head with your arms extended. You will repeat this action for as many repetitions as possible for two minutes. The final event is a 12-leg obstacle course, known as Maneuver under Fire (MANUF), which is roughly 25 yards long each way and 5 yards wide. The MANUF includes running, running with

weights, throwing a mock-grenade, and moving a mock-casualty. The first three legs are as follows: a sprint, a high-crawl on your hands and knees, and a zigzag through 5 markers spaced 5 yards apart. Then you will pick up a dummy casualty into an underarm carry and will drag the dummy through two markers covering about 10 yards, then lift the dummy into a fireman's carry and run the remaining leg and another 2 legs before placing the dummy back onto the ground. Then you pick up two 30 pound dumbbells and run 2 legs and then do another and leg in zigzag fashion while still carrying the weights. Then you place the weights down and pick up a mock-grenade, throw it at a target space about 22.5 yards away, and drop to the ground into prone position to "take cover". After getting back up from prone position and re-lifting the two 30 pound weights, running another zigzag leg with the weights, and then the final 2 legs straight with the weights to the finish line. A standard adult-weight dummy (180 pounds) will be used in your testing.

Obviously these tests are different than the current Air Force fitness test and so each event will be properly demonstrated to you prior to your execution of it. This is because these other tests focus more on skills more likely demanded in combat situations, versus your usual Air Force test which is designed for general fitness. Safety will be a priority and if the test is to be done outdoors there will be limitations as to temperature or weather prior to testing. If at any time during the testing you do not feel as though continuing would be a wise decision, you may stop at any time. Those testing will be paired up with a fellow volunteer and will alternate between the one testing and the one spotting and/or counting.

Discomfort and risks: Potential risks exist during this testing, which are similar to what you risk every time you physically exert yourself. Proper stretching and warm-up prior to testing and cool-down following testing will minimize risks, as well as being properly shown how to execute each of the events. If an adverse event does occur, there will be both a medical kit and/or quick transport to a medical facility available. Many of the participating personnel will be trained in Self Aide and Buddy Care (SABC). There will be UFPMs acting as medical observers at testing sites because they have been trained at identifying distress in physically active participants. There is also a research Medical Monitor available for further medical advice if necessary. Nonetheless, physical fitness tests that include these types of (in some cases, unfamiliar) events could lead to injuries such as twisted ankles, sprains, bruises, lower back pain, abdominal cramps and pain, muscle fatigue, strains, exhaustion, nausea, headaches, or other reasonable injuries caused from elevated levels of stress on the body, both physically and psychologically.

3. **Precautions for female subjects:** If you are female and pregnant you may not participate in this study. Otherwise, there are no additional precautions for females.

4. **Benefits:** You are not expected to benefit directly from participation in this research study. This is exploratory research only with no direct beneficiary other than the Air Force or its sister-services.

6. **Compensation:** If you are active duty military you will receive your normal active duty pay, but no additional compensation will be given for volunteering for this study.

7. **Alternatives:** Your alternative is to choose not to participate in this study. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. Notify one of the investigators of this study to discontinue.

8. **Entitlements and confidentiality:**

    a. Records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 5 U.S.C. 552a, and its implementing regulations and the Freedom of Information Act, 5 U.S.C. Sec 522, and its implementing regulations when applicable. It is intended that the only people having access to your information will be the researchers named above and this study's Medical Monitor or Consultant, the AFRL Wright Site IRB, the Air Force Surgeon General's Research Compliance office, the Director of Defense Research and Engineering office or any other IRB involved in the review and approval of this protocol. When no longer needed for research purposes your information will be destroyed in a secure manner (shredding). Complete confidentiality cannot be promised, in particular for military personnel, whose health or fitness for duty information may be required to be reported to appropriate medical or command authorities. If such information is to be reported, you will be informed of what is being reported and the reason for the report.

       Your entitlements to medical and dental care and/or compensation in the event of injury are governed by federal laws and regulations, and if you desire further information you may contact the base legal office (ASC, 257-6142 for Wright-Patterson AFB). You may contact your unit's UFPM regarding medical questions pertaining to this research study. A trained UFPM will be present at each of the two testing occasions. Additionally, the assigned medical monitor for this study is Maj Sarah Fortuna, 937-904-8100, sarah.fortuna@wpafb.af.mil.

    b. If an unanticipated event (medical misadventure) occurs during your participation in this study, you will be informed. If you are not competent at the time to understand the nature of the event, such information will be brought to the attention of your next of kin.

       Next of Kin or emergency contact information:

       Name______________________ Phone#________________

d. The decision to participate in this research is completely voluntary on your part. No one may coerce or intimidate you into participating in this program. You are participating because you want to. Capt. Thomas Worden, or another investigator, has adequately answered any and all questions you have about this study, your participation, and the procedures involved. Capt. Thomas Worden can be reached at (805) 345-6543. Capt. Thomas Worden, or another investigator will be available to answer any questions concerning procedures throughout this study. If significant new findings develop during the course of this research, which may relate to your decision to continue participation, you will be informed. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. Notify one of the investigators of this study to discontinue. The investigator or medical monitor of this study may terminate your participation in this study if she or he feels this to be in your best interest. If you have any questions or concerns about your participation in this study or your rights as a research subject, please contact Maj Sarah Fortuna, 937-904-8100, sarah.fortuna@wpafb.af.mil.

e. Your participation in this study may be photographed, filmed or audio/videotaped. The purpose of these recordings is for potential presentation or publication. Any release of records of your participation in this study may only be disclosed according to federal law, including the Federal Privacy Act, 55 U.S.C. 552a, and its implementing regulations. This means personal information will not be released to unauthorized source without your permission. These recordings may be used for presentation or publication. They will be stored in a locked cabinet in a room that is locked when not occupied. Only the investigators of this study will have access to this media. Any media not used in presentation or publication prior to June 2009 will be destroyed.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Volunteer Signature:_________________________________Date______________

Volunteer Name (printed):____

Advising Investigator Signature:_________________________ Date ____________

Investigator Name (printed):____

Witness Signature:______________________________________Date ___________

Witness Name (printed):____

We may wish to present some of the video/audio recordings from this study at scientific conventions or use photographs in journal publications. If you consent to the use of your image for publication or presentation in a scientific or academic setting, please sign below.

Volunteer Signature:___________________________________Date____________

Privacy Act Statement

Authority: We are requesting disclosure of personal information, to include your name. Researchers are authorized to collect personal information on research subjects under The Privacy Act-5 USC 552a, 10 USC 55, 10 USC 8013, 32 CFR 219, 45 CFR Part 46, and EO 9397, November 1943.

Purpose: It is possible that latent risks or injuries inherent in this experiment will not be discovered until some time in the future. The purpose of collecting this information is to aid researchers in locating you at a future date if further disclosures are appropriate.

Routine Uses: Information may be furnished to Federal, State and local agencies for any uses published by the Air Force in the Federal Register, 52 FR 16431, to include, furtherance of the research involved with this study and to provide medical care.

Disclosure: Disclosure of the requested information is voluntary. No adverse action whatsoever will be taken against you, and no privilege will be denied you based on the fact you do not disclose this information. However, your participation in this study may be impacted by a refusal to provide this information.

Appendix C. Health Screening Questionnaire

HEALTH SCREENING QUESTIONNAIRE

1. Do you have a health condition **not** addressed in a physical profile (AF Form 422) that could be aggravated by participating in a physical training program or in fitness testing or that would preclude your safe participation in this research?

_ Yes. Stop here; notify your Unit Fitness Program Manager (UFPM) and contact your Primary Care Manager for evaluation.

_ No. Proceed to next question.

2. Do you have any of the following?
- Chest discomfort with exertion
- Unusual shortness of breath
- Dizziness, fainting, blackouts

_ Yes. Stop here; notify your UFPM and contact your Primary Care Manager for evaluation.

_ No. Proceed to next question.

3. Are you less than 35 years of age?

_ Yes. Stop here; sign form and return to your Unit Fitness Program Manager.

_ No. Proceed to next question.

4. Do **two (2) or more** of the following risk factors apply to you?
- Physically inactive; that is, you have not participated in physical activities of at least a moderate level (i.e., that caused light sweating and slight-to-moderate increases in breathing or heart rate) for at least 30 minutes per session and for a minimum of 3 days per week for at least 3 months

- Smoked cigarettes in the last 30 days
- Diabetes
- High blood pressure that is not controlled
- High cholesterol that is not controlled
- Family history of heart disease (developed in father/brother before age 55 or mother/sister before age 65)
- Abdominal circumference >40" for males; >35" for females
- Age > 45 years for males; > 55 years for females

_ Yes. Stop here; notify your UFPM and contact your Primary Care Manager for evaluation.

_ No. Sign form and return to Unit Fitness Program Manager.

You must notify your Primary Care Manager and your UFPM if you have a change in health that may affect your ability to safely participate in physical activities.

Subject Code (First Initial of Last Name then Last Four of SSN):____________________Date: ______________

Office Symbol: ____ (only in order to identify your UFPM)

Authority: 10 USC 8013.
Routine Use: This information is not disclosed outside DoD.
Disclosure is Mandatory. Failure to provide this information may result in either administrative discharge or punishment under the UCMJ.

Appendix D. Combat Fitness Test Descriptions

DESCRIPTION OF TESTS, EVENTS, AND PERFORMANCE MEASURES

Test 1: APRT

Test Summary: The APRT test involves 6 events, spaced out over a period of up to 2 hours maximum. After each event, subjects will get between 5-10 minutes of a break, where they can stretch, eat, drink, or use the bathroom. None of the events are very complicated, but several are significantly different from what the Air Force is used to doing.

Event 1: Standing Long Jump
Equipment: Measuring tape, starting line, spotter
Description: Squat down, swing arms from starting line, and jump to furthest distance possible. Can be done at a sand pit or with a spotter marking the closest impact point
Duration: Two attempts
Performance Measure: Distance in inches from starting line and the closest impact point of furthest of two attempts

Event 2: Squat
Equipment: None
Description: Squat down so that thighs and arms are parallel with the ground with back straight, and then return back to a standing position. Repeat until time is up.
Duration: 1 minute
Performance Measure: Repetitions

Event 3: Shuttle Run
Equipment: Cones
Description: 300 yard shuttle run consisting of 25 yard increments, touching the line and changing directions until the 300 yards is completed (but running through the finish line instead of touching the line at the end of the last 25 yard sprint)
Duration: As fast as possible
Performance Measure: Completion time

Event 4: Pushups
Equipment: Spotter
Description: Same as the Air Force PT test pushups.
Duration: 1 minute
Performance Measure: Repetitions

Event 5: One-Mile Run
Equipment: Track
Description: Same as the Air Force PT test run, but only 1 mile. Walking is authorized.
Duration: As fast as possible

Performance Measure: Completion time

Event 6: Heel Hook
Equipment: Elevated bar (such as a pull-up bar), spotter
Description: Grip hands on either side of an elevated bar with arms extended. Without jumping off the ground, swing legs up over either side of the bar and connect them in a heel hook. Unhook heel and drop legs back down. Repeat until time is up.
Duration: 1 minute
Performance Measure: Repetitions

Test 2: Marine CFT

Test Summary: This test has three events, with sufficient rest time between events to allow for recovery, food and/or drink, or a restroom break. The 3rd event is the most significantly different from what the Air Force is used to.

Event 1: 880 Yard (1/2 Mile) Run
Equipment: Track
Description: Same as the Air Force PT test run, but only ½ mile. Walking is authorized.
Duration: As fast as possible
Performance Measure: Completion time

Event 2: 30-Pound Lifts
Equipment: 30-pound dumbbells, spotter
Description: Lift a weight from chest height to above the head with arms fully extended. Bring weight back down to chest height. Repeat until time is up.
Duration: 2 minutes
Performance Measure: Repetitions

Event 3: Four-Part Obstacle Course ("Maneuver Under Fire" Drill)
Equipment: Cones, 180-pound "casualty" dummy, 2x30-pound dumbbells, mock-grenade
Description: This event consists of 12 legs of 25 yards each. The first three legs are as follows: a sprint, a high-crawl on hands and knees, and a zigzag through 5 markers spaced 5 yards apart. Then pick up a dummy casualty into an underarm carry and drag the dummy through two markers covering about 10 yards, then lift the dummy into a fireman's carry and run the remaining leg and another 2 legs before placing the dummy back onto the ground. Then pick up two 30 pound dumbbells and run 2 legs and then do another and leg in zigzag fashion while still carrying the weights. Then place the weights down and pick up a mock-grenade, throw it at a target space about 22.5 yards away, and drop to the ground into prone position to "take cover". After getting back up from prone position and re-lifting the two 30 pound weights, running another zigzag leg with the weights, and then the final 2 legs straight with the weights to the finish line.
Duration: As fast as possible

Performance Measure: Completion time, plus 5 seconds if the mock-grenade throw misses its target.

Appendix E. Memorandum For Commanders

MEMORANDUM FOR WPAFB UNIT COMMANDERS

FROM: CAPT THOMAS WORDEN, RESEARCHER, AIR FORCE INSTITUTE OF TECHNOLOGY

SUBJECT: REQUEST FOR SUPPORT OF FITNESS TESTING RESEARCH

1. I am a Masters student at the Air Force Institute of Technology pursuing a thesis topic involving the correlations between general fitness (as intended to be measured by our current Air Force PT test) and combat fitness (as intended to be measured by different, more anaerobic and burst-speed focused fitness tests as designed by our sister services). The Marines are in the process of implementing a new bi-annual combat fitness test (CFT) designed to determine aptitude of skills more likely to be found in a combat environment. The Army has since 2002 been attempting to include more combat skills in their fitness program as well. Their FM 3-25.20DRAFT outlines their proposal for the Army Physical Readiness Test (APRT), which is a 6-part test different from their general 3-part fitness test.

2. In order to carry out my research, I am looking for Active Duty volunteers of all skill levels to take these sister-service combat-fitness tests. The screening for this testing will be the same as for the current AF fitness test. Volunteers will take both tests on two separate days, at least one week apart from each other. I will get data regarding the Air Force PT test via Air Force Portal printouts which volunteers will be asked to provide.

3. In order to simplify the data collection process and to maximize numbers of volunteers, with your permission, I am requesting your support of my research. I plan to coordinate with UFPMs at their normal meetings at the HAWC, to find out normal unit group PT locations and times. I ask of you to allow any volunteers from your unit present for group PT to be allowed to take my combat tests as an alternative to your normal group PT activities for the two testing days. If this is allowable for your unit, I ask of you to sign the signature block below, thereby giving me permission to collect data from volunteers from your unit who pass the screenings. Signed MFRs can be scanned and e-mailed to me, or physically returned to your UFPM whom can bring the signed form to me at their next meeting at the HAWC.

4. Thank you so much in advance for your support. For questions or concerns or requests for further information about these tests or this research protocol, please contact myself at thomas.worden@afit.edu or by calling my cell phone at 805-345-6543. My faculty advisor (and primary investigator) is Dr. Edward White, reachable at edward.white@afit.edu or by calling 937-785-3636x4540.

//signed//
THOMAS E. WORDEN, Capt, USAF
Researcher, Air Force Institute of Technology

By signing this form I authorize my unit personnel to participate, on a voluntary basis, for the research aforementioned, described in research protocol F-WR-2008-0041-H.

Name: ______________________ Signature: ______________________ Date: __________

UNIT: ______________________ UFPM Name: ______________________

Appendix F. Volunteer E-mailed Attachment

FOR VOLUNTEERS OF PROTOCOL: F-WR-2008-0041-H
"A Comparison of the U.S. Air Force Fitness Test and
Sister Services' Combat-Oriented Fitness Tests"

1) WHERE AND WHEN: Over two group pre-set testing periods at our Area B gym (WFFC), starting upstairs by the boxing ring.

2) TESTS: The following page outlines the different events in each of the two fitness tests.

3) UNIFORM: Although most events will be inside, both tests have one event outside. The Army test has a "heel hook" event just outside the gym, and the Marine test has the "MANUF" event outside. The heel hook doesn't take very long and folks can wait inside until they are "up". However, the MANUF will take a decent amount of time outside. The MANUF also requires a high-crawl so if the ground is cold, wet, icy, or snowy, it is certainly in your best interest to have more than just your PTs available (outdoor PTs with a gloves and a cap would be my suggestion). The uniform is whatever you want to wear, and there WILL be time granted between the indoor events and the outdoor event for those who would like to change.

4) DURATION: Depending on how many volunteers are testing, we should be able to do each test in about a 90 minute time-frame. The first week may take a little longer due to paperwork that needs to be signed.

5) WHAT TO BRING: Those volunteering will need to bring an Air Force Portal printout of their Air Force PT scores and a pen if possible. I also recommend a water bottle/-s or drink/-s for hydration.

6) CONFIDENTIALITY: There will be no names in this study what-so-ever and the results from this research can NOT possibly be used against anybody. For that reason, we will be using "marks" instead of names. So replace your name (either cut out or scratch out or mark over) on the AF Portal printout with the first letter of your last name followed by the last four of your SSN. For example: W3437. This is to ensure confidentiality requirements are met.

7) PROCEDURE: On test day one I will first collect Portal printouts, then everyone will sign letters of consent (which outline all the legal requirements that need to be presented, as well as nicely summarizing the protocol), then everyone will fill out a health screening questionnaire. Once they are submitted I will distribute the scoring sheets and commence with the Army PRT. After all events except for the heel hook, we'll take a short break to change clothes (if desired) and then do the heel hook event outside. Then I'll collect score sheets. On test day two we will meet at the same location and run through the Marine CFT. After the first two events we will break to change clothes (if desired) and then do the MANUF outside. Then I'll collect score sheets. Then we're done!

8) WEIGHT AND HEIGHT: I trust you all know your own height, and weight can be measured on the locker room scales. I can't go into the women's locker room so if you are a woman volunteer you can put that information on the scoring sheet yourself. I will provide time for all to do this just before we switch from the indoor events to the heel hook on the first testing day.

9) QUESTIONS: If anyone has any questions regarding this please let me know in advance. I can even send a copy of the protocol if anyone wants it early. The key here is to remember to bring the AF Portal printout, change your name to your "marking", and to bring a change of clothes for outside if it's cold. And of course, VOLUNTEER!

10) THANKS EVERYONE!!!

V/R,
Capt Tommy Worden
DESCRIPTION OF THE TWO TESTS:

Army Physical Readiness Test (APRT): The first event is the standing long jump, where you are to squat down and then leap as far as you can from a set line. You are encouraged to swing your arms but to try to land balanced so that you won't roll back onto your hands. You have two attempts to get the largest distance between the start line and your closest contact point with the ground. The second event is the squat, where you have 1 minute to perform as many precise squats as possible. You will squat down so that your thighs and arms are parallel with the ground with your back straight, and then you will return back to a standing position. The third event is a 300 yard shuttle run consisting of 25 yard increments, touching the line and changing directions until the 300 yards is completed. You may run through the finish line instead of touching the line at the end of the last 25 yard sprint. The fourth event is one minute of pushups done just like the current Air Force fitness test. The fifth event is a one mile run. Although walking is authorized, it is not encouraged. The goal is to complete one mile in the shortest time possible. The sixth and final event is the heel hook, where you grip your hands on either side of an elevated bar with your arms extended. You then swing your legs up over either side of the bar that is 6.5 feet high and 5 feet wide, and connect them in a heel hook. You will have spotters protecting you from falling while you repeat this as many times as you can in one minute.

Marine Combat Fitness Test (CFT): The first event is the 880 yard run (half-mile), known as Maneuver to Contact (MTC). Although walking is authorized, it is not encouraged. The goal is to complete the 1/2 mile in the shortest time possible. The second event is the 30 pound lift, known as the Ammunition-Can Lift (AL), where you lift a weight from chest height to above the head with your arms extended. You will repeat this action for as many repetitions as possible for two minutes. The final event is a 12-leg obstacle course, known as Maneuver under Fire (MANUF), which is roughly 25 yards long each way and 5 yards wide. The MANUF includes running, running with weights, throwing a mock-grenade, and moving a mock-casualty. The first three legs are as follows: a sprint, a high-crawl on your hands and knees, and a zigzag through 5 markers spaced 5 yards apart. Then you will pick up a dummy casualty into an underarm carry and will drag the dummy through two markers covering about 10 yards, then lift the dummy into a fireman's carry and run the remaining leg and another 2 legs before placing the dummy back onto the ground. Then you pick up two 30 pound dumbbells and run 2 legs and then do another and leg in zigzag fashion while still carrying the weights. Then you place the weights down and pick up a mock-grenade, throw it at a target space about 22.5 yards away, and drop to the ground into prone position to "take cover". After getting back up from prone position and re-lifting the two 30 pound weights, running another zigzag leg with the weights, and then the final 2 legs straight with the weights to the finish line. A standard adult-weight dummy (180 pounds) will be used in your testing.

Obviously these tests are different than the current Air Force fitness test and so each event will be properly demonstrated to you prior to your execution of it. This is because these other tests focus more on skills more likely demanded in combat situations, versus your usual Air Force test which is designed for general fitness. Safety will be a priority. If at any time during the testing you do not feel as though continuing would be a wise decision, you may stop at any time. Those testing will be paired up with a fellow volunteer and will alternate between the one testing and the one spotting and/or counting.

Appendix G. Combat Fitness Test Scoring Sheet

A Comparison of the US Air Force Fitness Test and
Sister Services' Combat-Oriented Fitness Tests
Protocol: F-WR-2008-0041-H

SCORING SHEET

Marking = First Initial of Last Name Followed by Last 4 of SSN (i.e. W3437):________________________

I have read and signed the Health screening questionnaire: yes________________ no_________________

I have read and signed (myself and witness) the Letter of Consent: yes____________ no_______________

I have submitted a "marked" print-out of my AF PFT scores from the AF Portal: yes_________no________

Career Field (AFSC)_________________________ Sex_________________ Age_______________________

TEST: **ARMY PHYSICAL READINESS TEST**

Describe your uniform/shoes for the indoor events: ____

Standing Long Jump: attempt 1 __________________ attempt 2 ________________ best ______________

Squats (1 minute): repetitions_________________

Shuttle Run: completion time___________________

Pushups (1 minute): repetitions_________________

One Mile Run: completion time__________________

On a scale from 0-10: How much exercise other than pushups, sit-ups, and running do you feel you do? ______________________

Describe your uniform/shoes for the outdoor event: ____

Heel Hook (1 minute): repetitions_________________

Date___________________

Height _________________Weight_____________

Marking of test taker (i.e. W3437)________________ Marking of witness (i.e. W3437)_________________

TEST: **MARINE COMBAT FITNESS TEST**

Describe your uniform/shoes for the indoor events: ____

880 Yard Run (1/2 Mile) or MTC: completion time___________________

30-Pound Lifts or AL (2 minutes): repetitions__________________

Describe your uniform/shoes for the outdoor event: ____

Obstacle Course or MANUF: (note: grenade throw missing target equates to a penalty of 5 seconds)

Completion time:_____________Grenade on target?___________________Total time:_________________

Date___________________

Marking of test taker (i.e. W3437)________________ Marking of witness (i.e. W3437)_________________

Appendix H. Protocol Approval Letter

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

MEMORANDUM FOR AFIT/ENC (EDWARD WHITE)

FROM: 711 HPW/IR (AFRL IRB)

SUBJECT: IRB approval for the use of human volunteers in research

1. Protocol title: A Critical Comparison of the US Air Force Fintness Test and Sister Services' Combat-Oriented Fitness Tests

2. Protocol number: F-WR-2008-0041-H

3. Risk: Minimal

4. Approval date: 22 Sep 2008

5. Expiration date: 21 Aug 2009

6. Scheduled renewal date: 21 Jul 2009

7. Type of review: Initial– Full Board Review

8. The above protocol has been reviewed and approved by the AFRL IRB via convened board review procedures.

9. This approval applies to human use research (as defined in 32 CFR 219 and AFI 40-402) portions of this project only. Attitude and opinion surveys associated with this research must be conducted IAW AFI 36-2601. Any FDA approvals must be received by the IRB prior to initiation of the study. If the study is being conducted under an IDE or IND, a copy of the FDA IDE or IND approval letter must be submitted to the IRB.

10. Any serious adverse event or issues resulting from this study should be reported immediately to the IRB. Amendments to protocols and/or revisions to informed consent documents must have IRB approval prior to implementation. Please retain both hard copy and electronic copy of the final approved protocol and informed consent document.

11. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator. Please ensure the timely submission of all required progress and final reports and use the templates provided on the AFRL IRB web site http://www.wpafb.af.mil/library/factsheets/factsheet.asp?id=7496 .

12. For questions or concerns, please contact the IRB administrator, Lt Andrew DiBella at Andrew.dibella@wpafb.af.mil or (937) 656-5437. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator.

Sarah Fortuna

SARAH FORTUNA, Maj, USAF, MC, FS
AFRL IRB

Appendix I. Department of Defense Assurance Approval Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

OCT 0 7 2008

MEMORANDUM FOR AIR FORCE INSTITUTE OF TECHNOLOGY
ATTN: DR. ADEDEJI B. BADIRU, AFIT/ENV DEPARTMENT HEAD

FROM: HQ USAF/SGRC
Office of the Surgeon General
5201 Leesburg Pike, Suite 1501B
Falls Church, VA 22041

SUBJECT: Approval of DoD Assurance

References: (a) 32 CFR 219, Protection of Human Subjects
(b) 10 USC 980, Limitation on Use of Humans as Experimental Subjects
(c) AFI 40-402, Protection of Human Subjects in Research
(d) DoDD 3216.02, Protection of Human Subjects and Adherence to Ethical Standards in DoD-Supported Research

On behalf of the AF Surgeon General, I have approved your DoD Assurance application and assigned a DoD number to your institution for the protocol listed below.

DoD Number	USAF Protocol Number and Title
F50288	**FWR20080041H, "A Critical Comparison of the US Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests"**

Attached is the signed copy of your Assurance of Compliance with the above references. Please maintain these documents with your research records.

We request that you provide this office with a copy of annual status reports and the final report when the project has been completed.

Thank you for your support in this matter. Please do not hesitate to contact me at 703-681-6277, telefax 703-681-6913, or robert.kang@pentagon.af.mil.

ROBERT N. KANG
Lt Col, USAF, BSC
Chief, Research Oversight/Compliance Division
Office of the Surgeon General

Attachment: DoD #F50288

Appendix J. Protocol Amendment Approval Letter

DEPARTMENT OF THE AIR FORCE
AIR FORCE RESEARCH LABORATORY
WRIGHT-PATTERSON AIR FORCE BASE OHIO 45433

22 OCT 2008

MEMORANDUM FOR AFIT/ENC (EDWARD WHITE)

FROM: 711 HPW/IR (AFRL IRB)

SUBJECT: IRB approval for the use of human volunteers in research

1. Protocol title: A Critical Comparison of the US Air Force Fitness Test and Sister Services' Combat-Oriented Fitness Tests

2. Protocol number: F-WR-2008-0041-H

3. Type of review: Amendment

4. The amendment to the above protocol has been reviewed and **approved** by the AFRL IRB via **expedited** review procedures. This protocol meets the criteria for expedited review under 32 CFR 219.110 (b) (2): Minor changes in previously approved research during the period (of one year or less) for which approval is authorized.

5. Any serious adverse event or issues resulting from this study should be reported immediately to the IRB. Amendments to protocols and/or revisions to informed consent documents must have IRB approval prior to implementation. Please retain both hard copy and electronic copy of the final approved protocol and informed consent document.

6. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator. Please ensure the timely submission of all required progress and final reports and use the templates provided on the AFRL IRB web site https://www.he-internal.afrl.af.mil/org/IRB/index.htm.

7. For questions or concerns, please contact the IRB administrator, Andrew DiBella at andrew.dibella@wpafb.af.mil or (937) 656-5437. All inquiries and correspondence concerning this protocol should include the protocol number and name of the primary investigator.

Sarah Fortuna

SARAH FORTUNA, Maj, USAF, MC, FS
AFRL IRB

Appendix K. Air Force Fitness Test Scoring Charts

Males Under 25

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤9:36	≥54	50.00
9:37-9:48	53	47.50
9:49-10:12	51-52	45.00
10:13-10:36	49-50	43.50
10:37-11:06	47-48	42.00
11:07-11:36	45-46	40.50
11:37-12:12	43-44	39.00
12:13-12:54	41-42	37.50
12:55-13:36	39-40	36.00
13:37-14:24	37-38	34.00
14:25-14:54	36	32.00
14:55-15:18	35	30.00
15:19-15:48	34	27.00
15:49-16:24	33	24.00
16:25-16:54	32	21.00
16:55-17:36	31	18.00
17:37-18:12	30	15.00
18:13-18:54	29	12.00
18:55-19:42	28	9.00
19:43-20:36	27	6.00
20:37-21:30	26	3.00
>21:30	<26	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥62	10.00
61	9.75
60	9.50
59	9.25
57-58	9.00
52-56	8.75
49-51	8.50
45-48	8.25
41-44	8.00
37-40	7.75
33-36	7.50
30-32	7.40
27-29	7.30
24-26	7.20
21-23	7.10
19-20	7.00
17-18	6.00
15-16	5.00
14	4.00
12-13	3.00
10-11	2.00
8-9	1.00
<8	0.00

1 minute Crunch (# Reps)	Component Points
≥55	10.00
53-54	9.50
52	9.00
50-51	8.75
48-49	8.50
46-47	8.25
44-45	8.00
42-43	7.75
40-41	7.50
38-39	7.40
36-37	7.30
35	7.20
33-34	7.10
32	7.00
30-31	6.00
28-29	4.00
27	2.00
<27	0.00

Males 25-29

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤9:36	≥54	50.00
9:37-9:48	53	47.50
9:49-10:12	51-52	45.00
10:13-10:36	49-50	43.50
10:37-11:06	47-48	42.00
11:07-11:36	45-46	40.50
11:37-12:12	43-44	39.00
12:13-12:54	41-42	37.50
12:55-13:36	39-40	36.00
13:37-14:24	37-38	34.00
14:25-14:54	36	32.00
14:55-15:18	35	30.00
15:19-15:48	34	27.00
15:49-16:24	33	24.00
16:25-16:54	32	21.00
16:55-17:36	31	18.00
17:37-18:12	30	15.00
18:13-18:54	29	12.00
18:55-19:42	28	9.00
19:43-20:36	27	6.00
20:37-21:30	26	3.00
>21:30	<26	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥57	10.00
56	9.75
55	9.50
54	9.25
52-53	9.00
48-51	8.75
45-47	8.50
41-44	8.25
37-40	8.00
34-36	7.75
30-33	7.50
27-29	7.40
25-26	7.30
23-24	7.20
20-22	7.10
17-19	7.00
15-16	6.00
13-14	5.00
11-12	4.00
10	3.00
9	2.00
7-8	1.00
<7	0.00

1 minute Crunch (# Reps)	Component Points
≥53	10.00
51-52	9.50
50	9.00
48-49	8.75
46-47	8.50
44-45	8.25
42-43	8.00
40-41	7.75
38-39	7.50
36-37	7.40
34-35	7.30
33	7.20
31-32	7.10
30	7.00
28-29	6.00
27	4.00
25-26	2.00
<25	0.00

Males 30-34

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤9:48	≥53	50.00
9:49-10:12	51-52	47.50
10:13-10:24	50	45.00
10:25-10:54	48-49	43.50
10:55-11:24	46-47	42.00
11:25-11:54	44-45	40.50
11:55-12:30	42-43	39.00
12:31-12:54	41	37.50
12:55-13:36	39-40	36.00
13:37-14:24	37-38	34.00
14:25-14:54	36	32.00
14:55-15:18	35	30.00
15:19-15:48	34	27.00
15:49-16:24	33	24.00
16:25-16:54	32	21.00
16:55-17:36	31	18.00
17:37-18:12	30	15.00
18:13-18:54	29	12.00
18:55-19:42	28	9.00
19:43-20:36	27	6.00
20:37-21:30	26	3.00
>21:30	<26	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥52	10.00
50-51	9.75
49	9.50
48	9.25
46-47	9.00
43-45	8.75
40-42	8.50
36-39	8.25
33-35	8.00
30-32	7.75
27-29	7.50
24-26	7.40
22-23	7.30
20-21	7.20
17-19	7.10
15-16	7.00
13-14	6.00
12	5.00
10-11	4.00
8-9	3.00
7	2.00
5-6	1.00
<5	0.00

1 minute Crunch (# Reps)	Component Points
≥51	10.00
49-50	9.50
48	9.00
46-47	8.75
44-45	8.50
42-43	8.25
40-41	8.00
38-39	7.75
36-37	7.50
34-35	7.40
33	7.30
31-32	7.20
30	7.10
28-29	7.00
26-27	6.00
25	4.00
23-24	2.00
<23	0.00

Males 35-39

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤9:48	≥53	50.00
9:49-10:12	51-52	47.50
10:13-10:24	50	45.00
10:25-10:54	48-49	43.50
10:55-11:24	46-47	42.00
11:25-11:54	44-45	40.50
11:55-12:30	42-43	39.00
12:31-12:54	41	37.50
12:55-13:36	39-40	36.00
13:37-14:24	37-38	34.00
14:25-14:54	36	32.00
14:55-15:18	35	30.00
15:19-15:48	34	27.00
15:49-16:24	33	24.00
16:25-16:54	32	21.00
16:55-17:36	31	18.00
17:37-18:12	30	15.00
18:13-18:54	29	12.00
18:55-19:42	28	9.00
19:43-20:36	27	6.00
20:37-21:30	26	3.00
>21:30	<26	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥46	10.00
45	9.75
44	9.50
42-43	9.25
41	9.00
38-40	8.75
35-37	8.50
32-34	8.25
30-31	8.00
27-29	7.75
24-26	7.50
21-23	7.40
19-20	7.30
17-18	7.20
15-16	7.10
13-14	7.00
11-12	6.00
9-10	5.00
8	4.00
6-7	3.00
5	2.00
3-4	1.00
<3	0.00

1 minute Crunch (# Reps)	Component Points
≥49	10.00
47-48	9.50
46	9.00
44-45	8.75
42-43	8.50
40-41	8.25
38-39	8.00
36-37	7.75
34-35	7.50
32-33	7.40
30-31	7.30
29	7.20
27-28	7.10
25-26	7.00
23-24	6.00
22	4.00
20-21	2.00
<20	0.00

Males 40-44

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤10:24	≥50	50.00
10:25-10:36	49	47.50
10:37-10:54	48	45.00
10:55-11:24	46-47	43.50
11:25-11:54	44-45	42.00
11:55-12:30	42-43	40.50
12:31-13:12	40-41	39.00
13:13-13:36	39	37.50
13:37-14:24	37-38	36.00
14:25-15:18	35-36	34.00
15:19-15:48	34	32.00
15:49-16:24	33	30.00
16:25-16:54	32	27.00
16:55-17:36	31	24.00
17:37-18:12	30	21.00
18:13-18:54	29	18.00
18:55-19:42	28	15.00
19:43-20:36	27	12.00
20:37-21:30	26	9.00
21:31-22:30	25	6.00
22:31-23:36	24	3.00
>23:36	<24	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥40	10.00
39	9.75
38	9.50
37	9.25
36	9.00
33-35	8.75
31-32	8.50
28-30	8.25
26-27	8.00
23-25	7.75
21-22	7.50
18-20	7.40
16-17	7.30
14-15	7.20
12-13	7.10
10-11	7.00
8-9	6.00
7	5.00
6	4.00
4-5	3.00
3	2.00
1-2	1.00
<1	0.00

1 minute Crunch (# Reps)	Component Points
≥47	10.00
45-46	9.50
43-44	9.00
41-42	8.75
39-40	8.50
37-38	8.25
35-36	8.00
33-34	7.75
31-32	7.50
29-30	7.40
27-28	7.30
26	7.20
24-25	7.10
22-23	7.00
20-21	6.00
19	4.00
17-18	2.00
<17	0.00

Males 45-49

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤10:24	≥50	50.00
10:25-10:36	49	47.50
10:37-10:54	48	45.00
10:55-11:24	46-47	43.50
11:25-11:54	44-45	42.00
11:55-12:30	42-43	40.50
12:31-13:12	40-41	39.00
13:13-13:36	39	37.50
13:37-14:24	37-38	36.00
14:25-15:18	35-36	34.00
15:19-15:48	34	32.00
15:49-16:24	33	30.00
16:25-16:54	32	27.00
16:55-17:36	31	24.00
17:37-18:12	30	21.00
18:13-18:54	29	18.00
18:55-19:42	28	15.00
19:43-20:36	27	12.00
20:37-21:30	26	9.00
21:31-22:30	25	6.00
22:31-23:36	24	3.00
>23:36	<24	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥40	10.00
39	9.75
37-38	9.50
35-36	9.25
33-34	9.00
30-32	8.75
27-29	8.50
25-26	8.25
22-24	8.00
20-21	7.75
18-19	7.50
16-17	7.40
14-15	7.30
12-13	7.20
10-11	7.10
9	7.00
7-8	6.00
6	5.00
5	4.00
4	3.00
2-3	2.00
1	1.00
0	0.00

1 minute Crunch (# Reps)	Component Points
≥45	10.00
43-44	9.50
41-42	9.00
39-40	8.75
37-38	8.50
35-36	8.25
33-34	8.00
31-32	7.75
29-30	7.50
27-28	7.40
25-26	7.30
24	7.20
22-23	7.10
20-21	7.00
18-19	6.00
17	4.00
15-16	2.00
<15	0.00

Males 50-54

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤11:06	≥47	50.00
11:07-11:24	46	47.50
11:25-11:36	45	45.00
11:37-12:12	43-44	43.50
12:13-12:54	41-42	42.00
12:55-13:36	39-40	40.50
13:37-14:24	37-38	39.00
14:25-15:18	35-36	37.50
15:19-15:48	34	36.00
15:49-16:54	32-33	34.00
16:55-17:36	31	32.00
17:37-18:12	30	30.00
18:13-18:54	29	27.00
18:55-19:42	28	24.00
19:43-20:36	27	21.00
20:37-21:30	26	18.00
21:31-22:30	25	15.00
22:31-23:36	24	12.00
23:37-24:48	23	9.00
24:49-26:06	22	6.00
26:07-27:36	21	3.00
>27:36	<21	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points	1 minute Crunch (# Reps)	Component Points
≥39	10.00	≥43	10.00
37-38	9.75	41-42	9.50
35-36	9.50	39-40	9.00
32-34	9.25	37-38	8.75
30-31	9.00	35-36	8.50
27-29	8.75	32-34	8.25
25-26	8.50	30-31	8.00
22-24	8.25	28-29	7.75
20-21	8.00	26-27	7.50
17-19	7.75	24-25	7.40
15-16	7.50	22-23	7.30
13-14	7.40	21	7.20
12	7.30	19-20	7.10
10-11	7.20	17-18	7.00
9	7.10	15-16	6.00
7-8	7.00	14	4.00
6	6.00	12-13	2.00
5	5.00	<12	0.00
4	4.00		
3	3.00		
2	2.00		
1	1.00		
0	0.00		

Males 55+

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤11:06	≥47	50.00
11:07-11:24	46	47.50
11:25-11:36	45	45.00
11:37-12:12	43-44	43.50
12:13-12:54	41-42	42.00
12:55-13:36	39-40	40.50
13:37-14:24	37-38	39.00
14:25-15:18	35-36	37.50
15:19-15:48	34	36.00
15:49-16:54	32-33	34.00
16:55-17:36	31	32.00
17:37-18:12	30	30.00
18:13-18:54	29	27.00
18:55-19:42	28	24.00
19:43-20:36	27	21.00
20:37-21:30	26	18.00
21:31-22:30	25	15.00
22:31-23:36	24	12.00
23:37-24:48	23	9.00
24:49-26:06	22	6.00
26:07-27:36	21	3.00
>27:36	<21	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<32.5	30.00
32.50	28.75
33.00	27.50
33.50	26.25
34.00	25.00
34.50	23.75
35.00	22.50
35.50	22.35
36.00	22.20
36.50	22.05
37.00	21.90
37.50	21.75
38.00	21.60
38.50	21.45
39.00	21.30
39.50	21.25
40.00	21.00
40.50	18.00
41.00	15.00
41.50	12.00
42.00	9.00
42.50	6.00
43.00	3.00
>43.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points	1 minute Crunch (# Reps)	Component Points
≥35	10.00	≥41	10.00
33-34	9.75	39-40	9.50
31-32	9.50	37-38	9.00
29-30	9.25	34-36	8.75
28	9.00	32-33	8.50
26-27	8.75	30-31	8.25
24-25	8.50	27-29	8.00
21-23	8.25	25-26	7.75
19-20	8.00	23-24	7.50
17-18	7.75	21-22	7.40
15-16	7.50	20	7.30
13-14	7.40	18-19	7.20
11-12	7.30	16-17	7.10
10	7.20	15	7.00
8-9	7.10	13-14	6.00
6-7	7.00	12	4.00
5	6.00	10-11	2.00
4	5.00	<10	0.00
3	4.00		
2	3.00		
1	2.00		
0	0.00		

Females Under 25

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤11:06	≥47	50.00
11:07-11:36	45-46	47.50
11:37-11:54	44	45.00
11:55-12:30	42-43	43.50
12:31-13:12	40-41	42.00
13:13-14:00	38-39	40.50
14:01-14:54	36-37	39.00
14:55-15:18	35	37.50
15:19-15:48	34	36.00
15:49-16:24	33	34.00
16:25-16:54	32	32.00
16:55-17:36	31	30.00
17:37-18:12	30	27.00
18:13-18:54	29	24.00
18:55-19:42	28	21.00
19:43-20:36	27	18.00
20:37-21:30	26	15.00
21:31-22:30	25	12.00
22:31-23:36	24	9.00
23:37-24:48	23	6.00
24:49-26:06	22	3.00
>26:06	<22	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥42	10.00
41	9.75
40	9.50
38-39	9.25
37	9.00
34-36	8.75
31-33	8.50
27-30	8.25
24-26	8.00
21-23	7.75
18-20	7.50
16-17	7.40
14-15	7.30
12-13	7.20
10-11	7.10
9	7.00
8	6.00
7	5.00
6	4.00
5	3.00
4	2.00
3	1.00
<3	0.00

1 minute Crunch (# Reps)	Component Points
≥51	10.00
50	9.50
49	9.00
46-48	8.75
44-45	8.50
42-43	8.25
40-41	8.00
37-39	7.75
35-36	7.50
33-34	7.40
30-32	7.30
28-29	7.20
26-27	7.10
24-25	7.00
22-23	6.00
20-21	4.00
18-19	2.00
<18	0.00

Females 25-29

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤11:24	≥46	50.00
11:25-11:36	45	47.50
11:37-11:54	44	45.00
11:55-12:30	42-43	43.50
12:31-13:12	40-41	42.00
13:13-14:00	38-39	40.50
14:01-14:54	36-37	39.00
14:55-15:18	35	37.50
15:19-15:48	34	36.00
15:49-16:24	33	34.00
16:25-16:54	32	32.00
16:55-17:36	31	30.00
17:37-18:12	30	27.00
18:13-18:54	29	24.00
18:55-19:42	28	21.00
19:43-20:36	27	18.00
20:37-21:30	26	15.00
21:31-22:30	25	12.00
22:31-23:36	24	9.00
23:37-24:48	23	6.00
24:49-26:06	22	3.00
>26:06	21	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥41	10.00
40	9.75
38-39	9.50
36-37	9.25
35	9.00
31-34	8.75
28-30	8.50
25-27	8.25
22-24	8.00
19-21	7.75
16-18	7.50
14-15	7.40
13	7.30
11-12	7.20
10	7.10
8-9	7.00
7	6.00
6	5.00
5	4.00
4	3.00
3	2.00
2	1.00
<2	0.00

1 minute Crunch (# Reps)	Component Points
≥47	10.00
46	9.50
45	9.00
42-44	8.75
40-41	8.50
38-39	8.25
36-37	8.00
34-35	7.75
31-33	7.50
29-30	7.40
27-28	7.30
25-26	7.20
23-24	7.10
21-22	7.00
19-20	6.00
17-18	4.00
15-16	2.00
<15	0.00

Females 30-34

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤11:54	≥44	50.00
11:55-12:30	42-43	47.50
12:31-12:54	41	45.00
12:55-13:12	40	43.50
13:13-13:36	39	42.00
13:37-14:24	37-38	40.50
14:25-14:54	36	39.00
14:55-15:18	35	37.50
15:19-15:48	34	36.00
15:49-16:24	33	34.00
16:25-16:54	32	32.00
16:55-17:36	31	30.00
17:37-18:12	30	27.00
18:13-18:54	29	24.00
18:55-19:42	28	21.00
19:43-20:36	27	18.00
20:37-21:30	26	15.00
21:31-22:30	25	12.00
22:31-23:36	24	9.00
23:37-24:48	23	6.00
24:49-26:06	22	3.00
>26:06	<22	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥40	10.00
39	9.75
37-38	9.50
35-36	9.25
33-34	9.00
29-32	8.75
26-28	8.50
23-25	8.25
20-22	8.00
17-19	7.75
14-16	7.50
12-13	7.40
11	7.30
10	7.20
9	7.10
7-8	7.00
6	6.00
5	5.00
4	4.00
3	3.00
2	2.00
1	1.00
0	0.00

1 minute Crunch (# Reps)	Component Points
≥42	10.00
41	9.50
40	9.00
37-39	8.75
35-36	8.50
33-34	8.25
31-32	8.00
29-30	7.75
27-28	7.50
25-26	7.40
23-24	7.30
22	7.20
20-21	7.10
18-19	7.00
16-17	6.00
13-15	4.00
11-12	2.00
<11	0.00

Females 35-39

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤11:54	≥44	50.00
11:55-12:30	42-43	47.50
12:31-12:54	41	45.00
12:55-13:12	40	43.50
13:13-13:36	39	42.00
13:37-14:24	37-38	40.50
14:25-14:54	36	39.00
14:55-15:18	35	37.50
15:19-15:48	34	36.00
15:49-16:24	33	34.00
16:25-16:54	32	32.00
16:55-17:36	31	30.00
17:37-18:12	30	27.00
18:13-18:54	29	24.00
18:55-19:42	28	21.00
19:43-20:36	27	18.00
20:37-21:30	26	15.00
21:31-22:30	25	12.00
22:31-23:36	24	9.00
23:37-24:48	23	6.00
24:49-26:06	22	3.00
>26:06	<22	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥30	10.00
29	9.75
28	9.50
27	9.25
26	9.00
23-25	8.75
21-22	8.50
19-20	8.25
17-18	8.00
15-16	7.75
13-14	7.50
11-12	7.40
10	7.30
9	7.20
8	7.10
6-7	7.00
4-5	6.00
3	4.00
1-2	2.00
<1	0.00

1 minute Crunch (# Reps)	Component Points
≥40	10.00
38-39	9.50
37	9.00
35-36	8.75
33-34	8.50
31-32	8.25
29-30	8.00
27-28	7.75
25-26	7.50
23-24	7.40
21-22	7.30
20	7.20
18-19	7.10
16-17	7.00
14-15	6.00
12-13	4.00
9-11	2.00
<9	0.00

Females 40-44

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤12:30	≥42	50.00
12:31-12:54	41	47.50
12:55-13:12	40	45.00
13:13-14:00	38-39	43.50
14:01-14:54	36-37	42.00
14:55-15:48	34-35	40.50
15:49-16:24	33	39.00
16:25-16:54	32	37.50
16:55-17:36	31	36.00
17:37-18:12	30	34.00
18:13-18:54	29	32.00
18:55-19:42	28	30.00
19:43-20:36	27	27.00
20:37-21:30	26	24.00
21:31-22:30	25	21.00
22:31-23:36	24	18.00
23:37-24:48	23	15.00
24:49-26:06	22	12.00
26:07-27:36	21	9.00
27:37-29:18	20	6.00
29:19-31:12	19	3.00
>31:12	<19	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points	1 minute Crunch (# Reps)	Component Points
≥20	10.00	≥38	10.00
19	9.50	36-37	9.50
18	9.00	34-35	9.00
16-17	8.75	32-33	8.75
15	8.50	30-31	8.50
14	8.25	28-29	8.25
13	8.00	26-27	8.00
12	7.75	24-25	7.75
11	7.50	22-23	7.50
9-10	7.40	20-21	7.40
8	7.30	18-19	7.30
7	7.20	17	7.20
6	7.10	15-16	7.10
5	7.00	13-14	7.00
3-4	6.00	11-12	6.00
2	4.00	9-10	4.00
1	2.00	7-8	2.00
0	0.00	<7	0.00

Females 45-49

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤12:30	≥42	50.00
12:31-12:54	41	47.50
12:55-13:12	40	45.00
13:13-14:00	38-39	43.50
14:01-14:54	36-37	42.00
14:55-15:48	34-35	40.50
15:49-16:24	33	39.00
16:25-16:54	32	37.50
16:55-17:36	31	36.00
17:37-18:12	30	34.00
18:13-18:54	29	32.00
18:55-19:42	28	30.00
19:43-20:36	27	27.00
20:37-21:30	26	24.00
21:31-22:30	25	21.00
22:31-23:36	24	18.00
23:37-24:48	23	15.00
24:49-26:06	22	12.00
26:07-27:36	21	9.00
27:37-29:18	20	6.00
29:19-31:12	19	3.00
>31:12	<19	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points	1 minute Crunch (# Reps)	Component Points
≥18	10.00	≥34	10.00
17	9.50	33	9.50
16	9.00	32	9.00
14-15	8.75	30-31	8.75
13	8.50	28-29	8.50
12	8.25	26-27	8.25
11	8.00	24-25	8.00
10	7.75	22-23	7.75
9	7.50	20-21	7.50
8	7.40	18-19	7.40
7	7.30	16-17	7.30
6	7.20	14-15	7.20
5	7.10	12-13	7.10
4	7.00	10-11	7.00
3	6.00	8-9	6.00
2	4.00	7	4.00
1	2.00	6	2.00
0	0.00	<6	0.00

Females 50-54

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤14:24	≥37	50.00
14:25-14:54	36	47.50
14:55-15:18	35	45.00
15:19-16:24	33-34	43.50
16:25-16:54	32	42.00
16:55-17:36	31	40.50
17:37-18:12	30	39.00
18:13-18:54	29	37.50
18:55-19:42	28	36.00
19:43-20:36	27	34.00
20:37-21:30	26	32.00
21:31-22:30	25	30.00
22:31-23:36	24	27.00
23:37-24:48	23	24.00
24:49-26:06	22	21.00
26:07-27:36	21	18.00
27:37-29:18	20	15.00
29:19-31:12	19	12.00
31:13-33:18	18	9.00
33:19-35:48	17	6.00
35:49-38:36	16	3.00
>38:36	<16	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥16	10.00
15	9.50
14	9.00
13	8.75
12	8.50
11	8.25
10	8.00
9	7.75
8	7.50
7	7.40
6	7.30
5	7.20
4	7.10
3	7.00
2	6.00
1	3.00
<1	0.00

1 minute Crunch (# Reps)	Component Points
≥30	10.00
29	9.00
27-28	8.75
25-26	8.50
23-24	8.25
21-22	8.00
19-20	7.75
17-18	7.50
15-16	7.40
13-14	7.30
11-12	7.20
9-10	7.10
7-8	7.00
5-6	6.00
3-4	4.00
1-2	2.00
<1	0.00

Females 55+

Aerobic Fitness

1.5-Mile Run Time (min.)	Bike Test (VO_2)	Component Points
≤14:24	≥37	50.00
14:25-14:54	36	47.50
14:55-15:18	35	45.00
15:19-16:24	33-34	43.50
16:25-16:54	32	42.00
16:55-17:36	31	40.50
17:37-18:12	30	39.00
18:13-18:54	29	37.50
18:55-19:42	28	36.00
19:43-20:36	27	34.00
20:37-21:30	26	32.00
21:31-22:30	25	30.00
22:31-23:36	24	27.00
23:37-24:48	23	24.00
24:49-26:06	22	21.00
26:07-27:36	21	18.00
27:37-29:18	20	15.00
29:19-31:12	19	12.00
31:13-33:18	18	9.00
33:19-35:48	17	6.00
35:49-38:36	16	3.00
>38:36	<16	0.00

Body Composition

Abdominal Circumference (inches)	Component Points
<29.5	30.00
29.50	28.75
30.00	27.50
30.50	26.25
31.00	25.00
31.50	23.75
32.00	22.50
32.50	22.30
33.00	22.00
33.50	21.80
34.00	21.50
34.50	21.30
35.00	21.00
35.50	18.00
36.00	15.00
36.50	12.00
37.00	9.00
37.50	6.00
38.00	3.00
>38.00	0.00

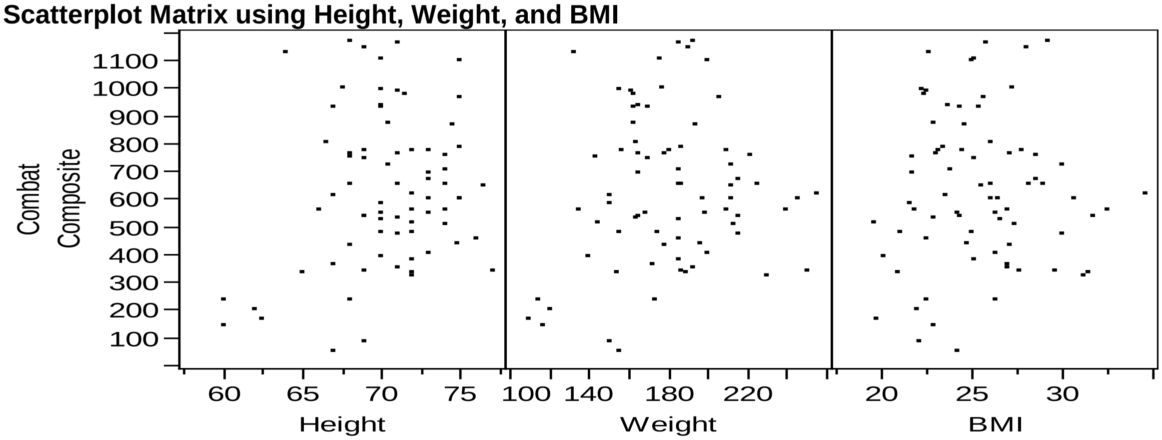
Muscle Fitness

1 minute Push-up (# Reps)	Component Points
≥14	10.00
13	9.50
12	9.00
10-11	8.50
9	8.00
7-8	7.50
6	7.40
5	7.30
4	7.20
3	7.10
2	7.00
1	6.00
<1	0.00

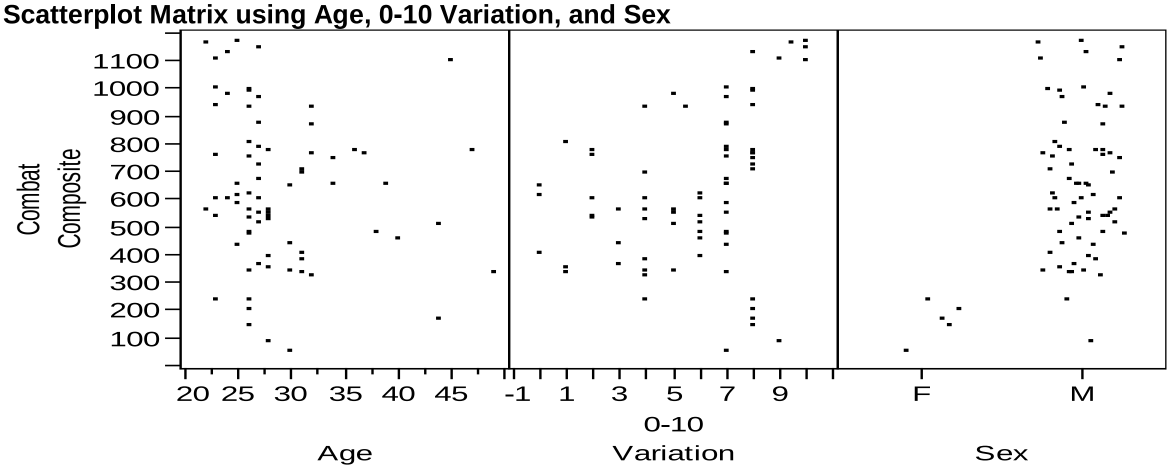
1 minute Crunch (# Reps)	Component Points
≥27	10.00
26	9.50
25	9.00
23-24	8.75
21-22	8.50
19-20	8.25
18	8.00
16-17	7.75
14-15	7.50
12-13	7.40
10-11	7.30
8-9	7.20
6-7	7.10
4-5	7.00
3	6.00
2	4.00
1	2.00
<1	0.00

Appendix L. Scatterplots of Variables to Combat Composite

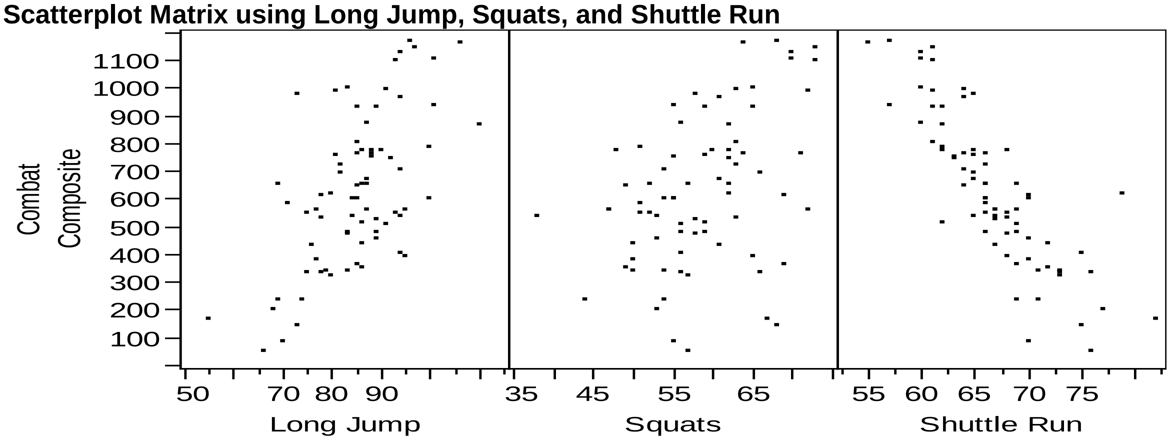
Scatterplot Matrix using Height, Weight, and BMI



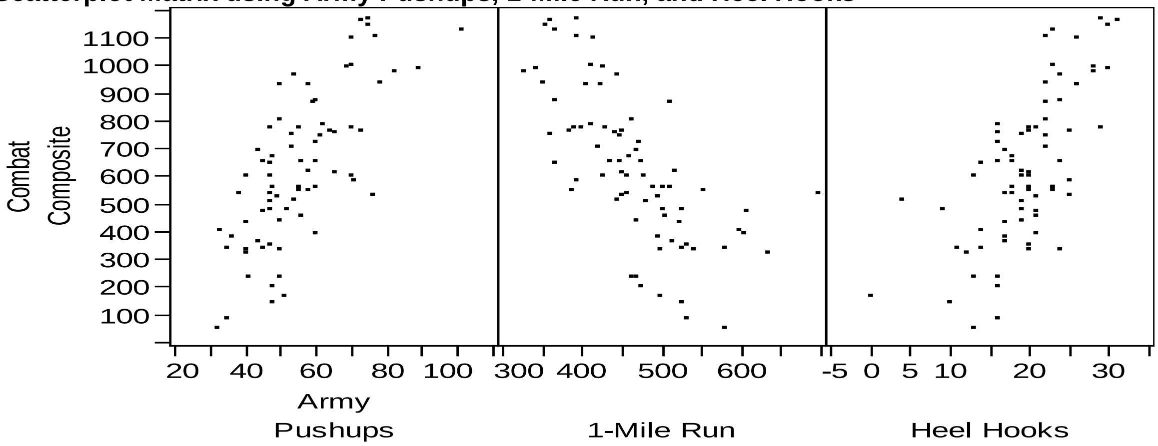
Scatterplot Matrix using Age, 0-10 Variation, and Sex



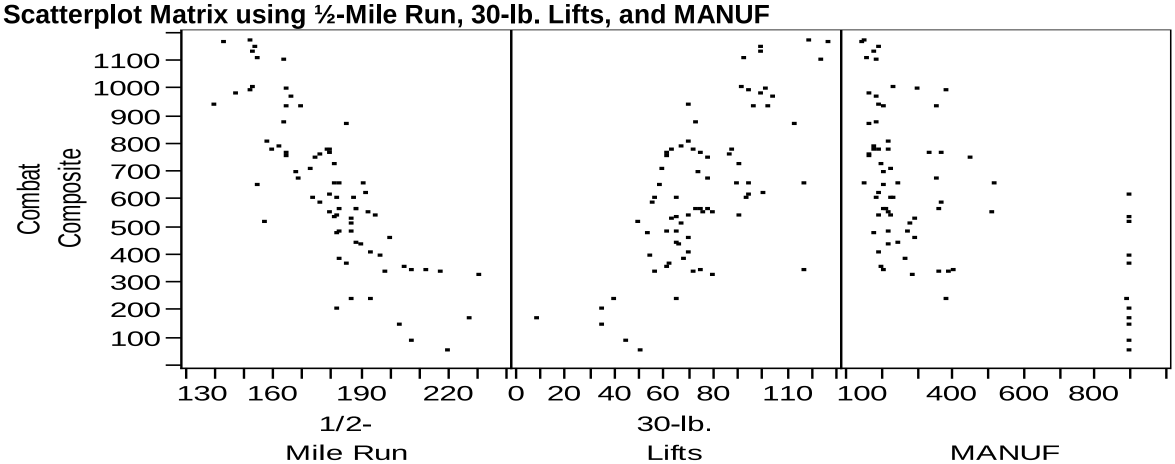
Scatterplot Matrix using Long Jump, Squats, and Shuttle Run



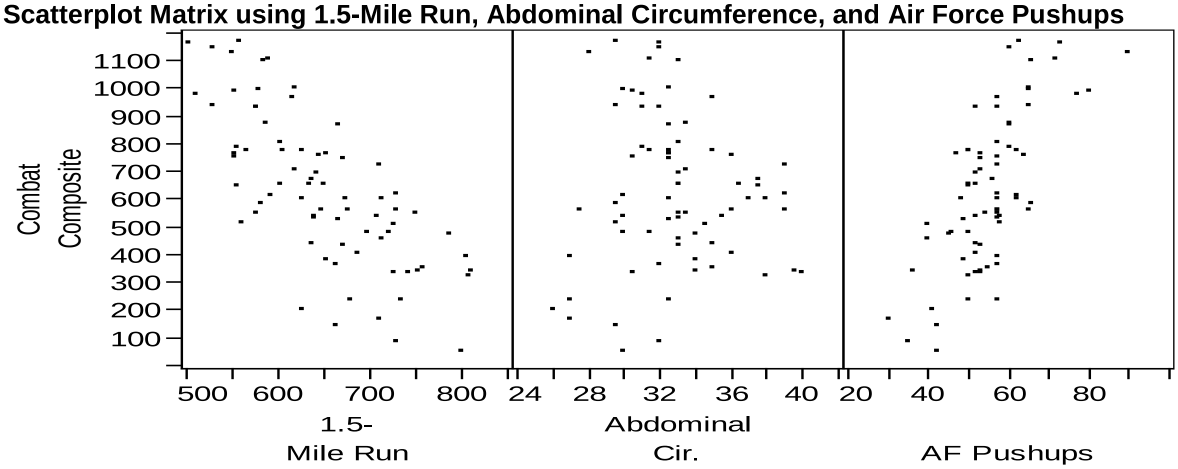
Scatterplot Matrix using Army Pushups, 1-Mile Run, and Heel Hooks



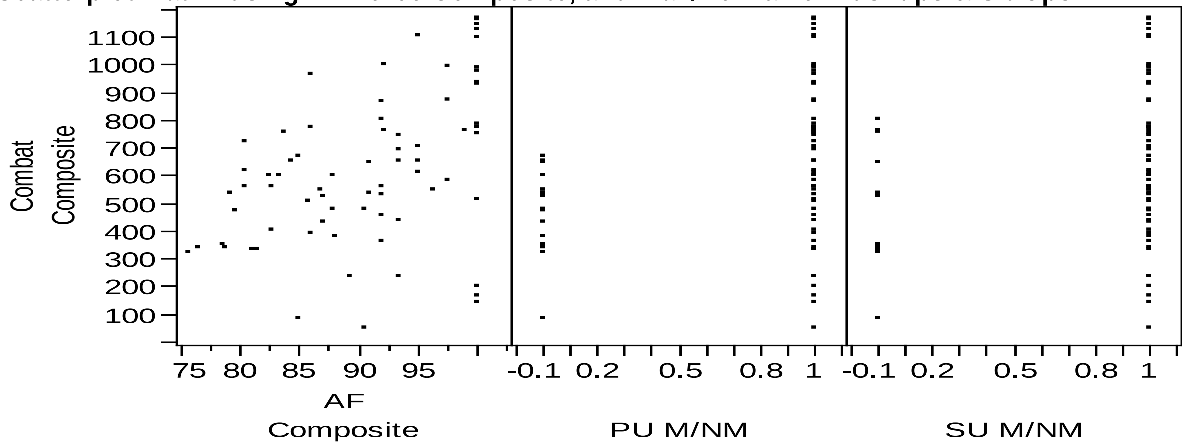
Scatterplot Matrix using ½-Mile Run, 30-lb. Lifts, and MANUF



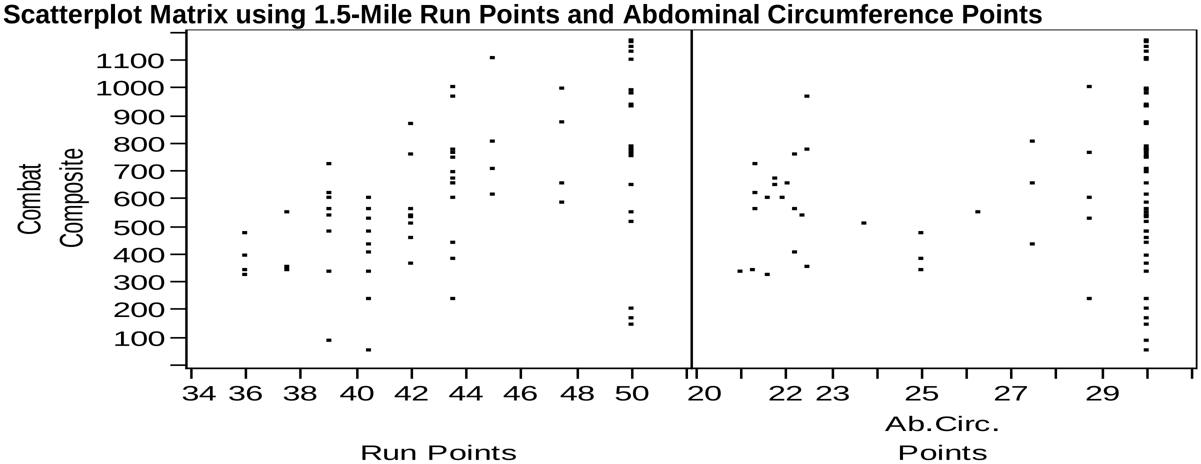
Scatterplot Matrix using 1.5-Mile Run, Abdominal Circumference, and Air Force Pushups



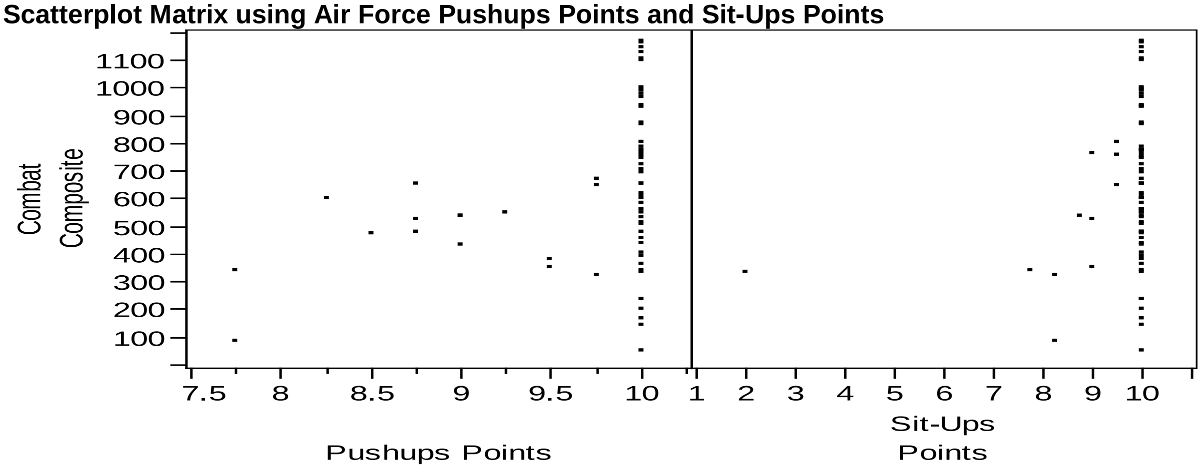
Scatterplot Matrix using Air Force Composite, and Max/No Max of Pushups & Sit-Ups



Scatterplot Matrix using 1.5-Mile Run Points and Abdominal Circumference Points

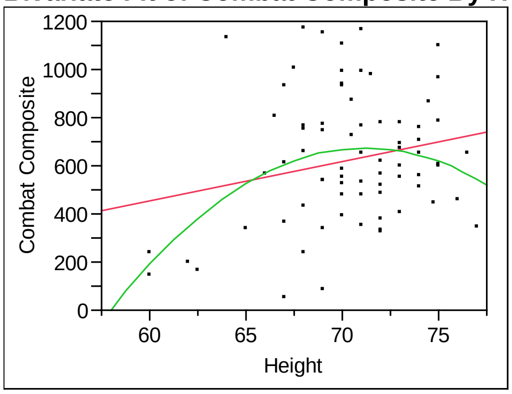


Scatterplot Matrix using Air Force Pushups Points and Sit-Ups Points



Appendix M. Bivariate Fits of Combat Composite by Variables

Bivariate Fit of Combat Composite By Height



Linear Fit

Combat Composite = -515.4526 + 16.165169*Height

Summary of Fit

RSquare	0.045619
RSquare Adj	0.032364
Root Mean Square Error	267.3829
Mean of Response	622.6081
Observations (or Sum Wgts)	74

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	246052.6	246053	3.4416
Error	72	5147541.0	71494	**Prob > F**
C. Total	73	5393593.6		0.0677

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-515.4526	614.2453	-0.84	0.4042
Height	16.165169	8.713646	1.86	0.0677

Polynomial Fit Degree=2

Combat Composite = 253.34258 + 5.944417*Height - 3.8692319*(Height-70.402)^{2}2

Summary of Fit

RSquare	0.11784
RSquare Adj	0.09299
Root Mean Square Error	258.8712
Mean of Response	622.6081
Observations (or Sum Wgts)	74

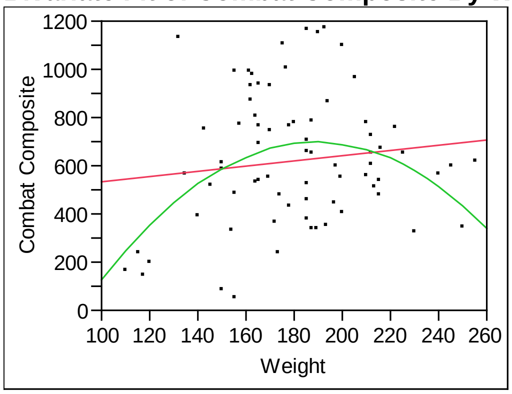
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	635578.6	317789	4.7421
Error	71	4758015.1	67014	**Prob > F**
C. Total	73	5393593.6		0.0117

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	253.34258	674.7905	0.38	0.7085
Height	5.944417	9.441531	0.63	0.5310
(Height-70.402)^2	-3.869232	1.604872	-2.41	0.0185

Bivariate Fit of Combat Composite By Weight



Linear Fit

Combat Composite = 424.88564 + 1.0964004*Weight

Summary of Fit

RSquare	0.016031
RSquare Adj	0.002365
Root Mean Square Error	271.4961
Mean of Response	622.6081
Observations (or Sum Wgts)	74

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	86464.4	86464.4	1.1730
Error	72	5307129.2	73710.1	**Prob > F**
C. Total	73	5393593.6		0.2824

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	424.88564	185.266	2.29	0.0247
Weight	1.0964004	1.012311	1.08	0.2824

Polynomial Fit Degree=2

Combat Composite = 458.07396 + 1.2977465*Weight - 0.0715005*(Weight-180.338)^2

Summary of Fit

RSquare	0.141107
RSquare Adj	0.116913
Root Mean Square Error	255.4344
Mean of Response	622.6081
Observations (or Sum Wgts)	74

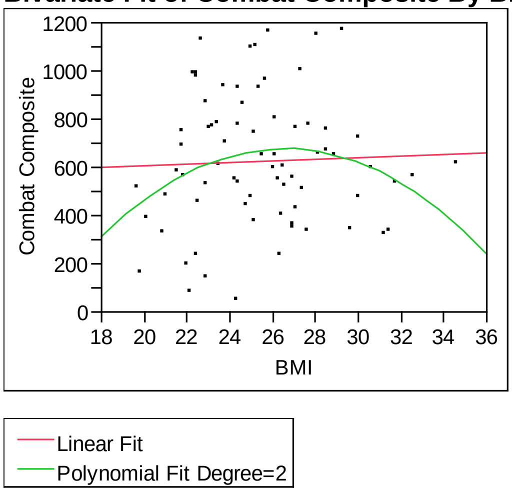
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	761074.5	380537	5.8323
Error	71	4632519.1	65247	**Prob > F**
C. Total	73	5393593.6		0.0045

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	458.07396	174.6111	2.62	0.0106
Weight	1.2977465	0.954479	1.36	0.1782
(Weight-180.338)^2	-0.0715	0.022236	-3.22	0.0020

Bivariate Fit of Combat Composite By BMI



Linear Fit

Combat Composite = 535.89995 + 3.4076696*BMI

Summary of Fit

RSquare	0.001598
RSquare Adj	-0.01227
Root Mean Square Error	273.48
Mean of Response	622.6081
Observations (or Sum Wgts)	74

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	8620.9	8620.9	0.1153
Error	72	5384972.7	74791.3	**Prob > F**
C. Total	73	5393593.6		0.7352

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	535.89995	257.3635	2.08	0.0409
BMI	3.4076696	10.03704	0.34	0.7352

Polynomial Fit Degree=2

Combat Composite = 390.03012 + 11.084081*BMI - 4.9296362*(BMI-25.445)^2

Summary of Fit

RSquare	0.057507
RSquare Adj	0.030958
Root Mean Square Error	267.5771
Mean of Response	622.6081
Observations (or Sum Wgts)	74

Analysis of Variance

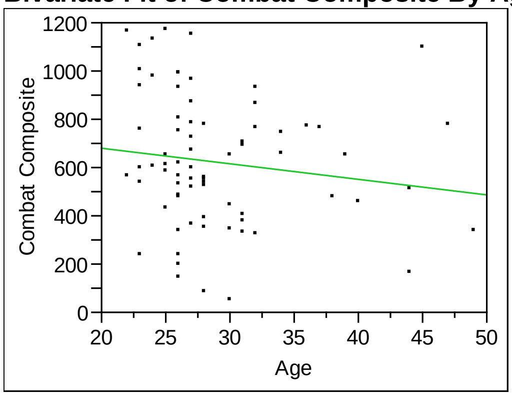
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	310169.6	155085	2.1661
Error	71	5083424.0	71598	**Prob > F**

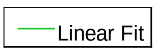
Source	DF	Sum of Squares	Mean Square	F Ratio
C. Total	73	5393593.6		0.1221

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	390.03012	261.648	1.49	0.1405
BMI	11.084081	10.50864	1.05	0.2951
$(BMI-25.445)^2 2$	-4.929636	2.402067	-2.05	0.0438

Bivariate Fit of Combat Composite By Age





Linear Fit

Combat Composite = 814.52437 - 6.60549*Age

Summary of Fit

RSquare	0.021306
RSquare Adj	0.007714
Root Mean Square Error	270.7673
Mean of Response	622.6081
Observations (or Sum Wgts)	74

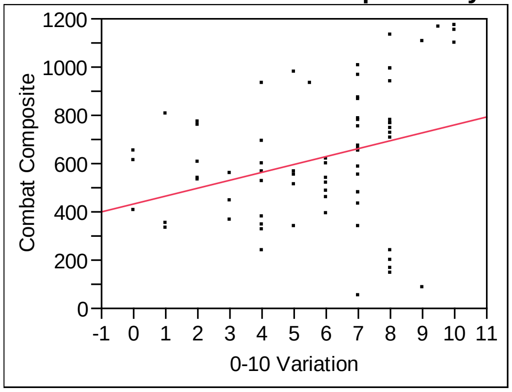
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	114918.6	114919	1.5675
Error	72	5278675.1	73315	**Prob > F**
C. Total	73	5393593.6		0.2146

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	814.52437	156.4879	5.21	<.0001
Age	-6.60549	5.276017	-1.25	0.2146

Bivariate Fit of Combat Composite By 0-10 Variation



Linear Fit

Combat Composite = 433.26675 + 32.890283*0-10 Variation

Summary of Fit

RSquare	0.096095
RSquare Adj	0.083541
Root Mean Square Error	260.2161
Mean of Response	622.6081
Observations (or Sum Wgts)	74

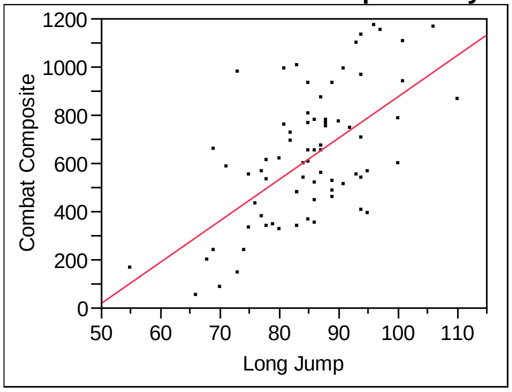
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	518299.8	518300	7.6544
Error	72	4875293.9	67712	**Prob > F**
C. Total	73	5393593.6		0.0072

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	433.26675	74.8239	5.79	<.0001
0-10 Variation	32.890283	11.88807	2.77	0.0072

Bivariate Fit of Combat Composite By Long Jump



Linear Fit

Combat Composite = -837.2589 + 17.158539*Long Jump

Summary of Fit

RSquare	0.375854
RSquare Adj	0.367185
Root Mean Square Error	216.2301
Mean of Response	622.6081
Observations (or Sum Wgts)	74

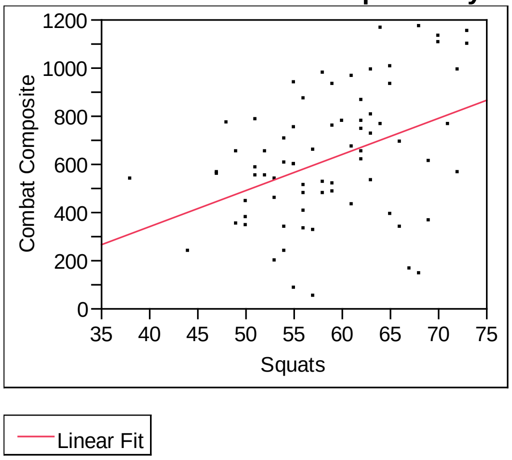
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2027201.6	2027202	43.3576
Error	72	3366392.0	46755	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-837.2589	223.1281	-3.75	0.0004
Long Jump	17.158539	2.605841	6.58	<.0001

Bivariate Fit of Combat Composite By Squats



Linear Fit

Combat Composite = -256.234 + 14.977964*Squats

Summary of Fit

RSquare	0.169212
RSquare Adj	0.157673
Root Mean Square Error	249.4698
Mean of Response	622.6081
Observations (or Sum Wgts)	74

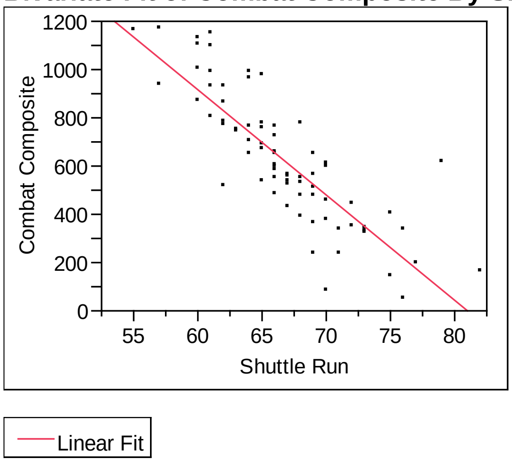
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	912661.2	912661	14.6647
Error	72	4480932.5	62235	**Prob > F**
C. Total	73	5393593.6		0.0003

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-256.234	231.3205	-1.11	0.2717
Squats	14.977964	3.911253	3.83	0.0003

Bivariate Fit of Combat Composite By Shuttle Run



Linear Fit

Combat Composite = 3544.8356 - 43.791988*Shuttle Run

Summary of Fit

RSquare	0.701373
RSquare Adj	0.697225
Root Mean Square Error	149.5676
Mean of Response	622.6081
Observations (or Sum Wgts)	74

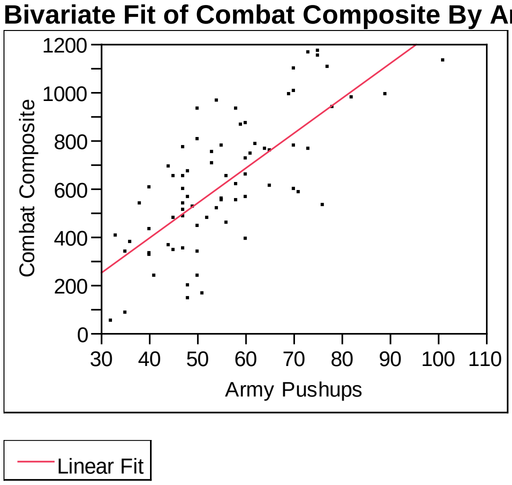
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3782919.9	3782920	169.1033
Error	72	1610673.7	22370	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3544.8356	225.3897	15.73	<.0001
Shuttle Run	-43.79199	3.367585	-13.00	<.0001

Bivariate Fit of Combat Composite By Army Pushups



Linear Fit

Combat Composite = -183.9283 + 14.500412*Army Pushups

Summary of Fit

RSquare	0.534209
RSquare Adj	0.527739
Root Mean Square Error	186.7964
Mean of Response	622.6081
Observations (or Sum Wgts)	74

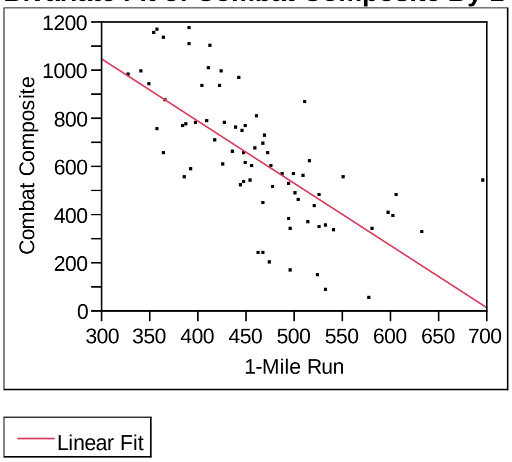
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2881304.8	2881305	82.5757
Error	72	2512288.8	34893	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-183.9283	91.37374	-2.01	0.0479
Army Pushups	14.500412	1.595711	9.09	<.0001

Bivariate Fit of Combat Composite By 1-Mile Run



Linear Fit

Combat Composite = 1816.9905 - 2.5723019*1-Mile Run

Summary of Fit

RSquare	0.485269
RSquare Adj	0.47812
Root Mean Square Error	196.3645
Mean of Response	622.6081
Observations (or Sum Wgts)	74

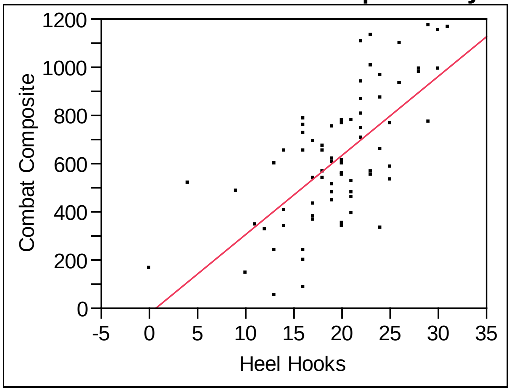
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2617344.5	2617344	67.8789
Error	72	2776249.2	38559	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1816.9905	146.7554	12.38	<.0001
1-Mile Run	-2.572302	0.312216	-8.24	<.0001

Bivariate Fit of Combat Composite By Heel Hooks



Linear Fit

Combat Composite = -22.38856 + 32.849108*Heel Hooks

Summary of Fit

RSquare	0.473981
RSquare Adj	0.466676
Root Mean Square Error	198.5059
Mean of Response	622.6081
Observations (or Sum Wgts)	74

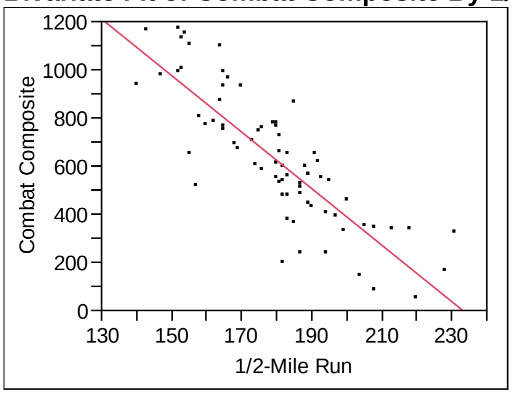
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2556462.7	2556463	64.8773
Error	72	2837130.9	39405	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-22.38856	83.33619	-0.27	0.7890
Heel Hooks	32.849108	4.078282	8.05	<.0001

Bivariate Fit of Combat Composite By 1/2-Mile Run



Linear Fit

Combat Composite = 2732.9208 - 11.714285*1/2-Mile Run

Summary of Fit

RSquare	0.699083
RSquare Adj	0.694903
Root Mean Square Error	150.1401
Mean of Response	622.6081
Observations (or Sum Wgts)	74

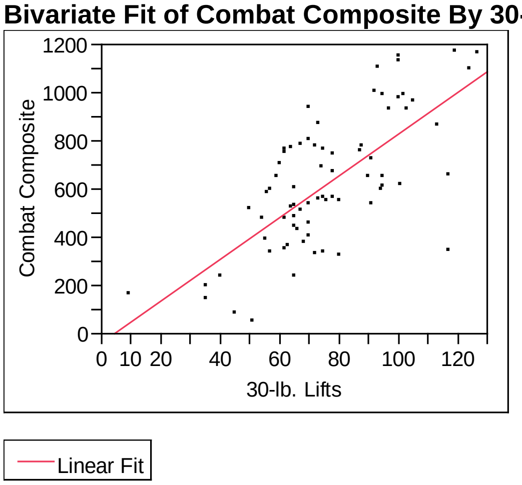
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3770567.1	3770567	167.2683
Error	72	1623026.6	22542	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	2732.9208	164.1007	16.65	<.0001
1/2-Mile Run	-11.71429	0.905751	-12.93	<.0001

Bivariate Fit of Combat Composite By 30-lb. Lifts



Linear Fit

Combat Composite = -35.98354 + 8.641096*30-lb. Lifts

Summary of Fit

RSquare	0.496146
RSquare Adj	0.489148
Root Mean Square Error	194.2787
Mean of Response	622.6081
Observations (or Sum Wgts)	74

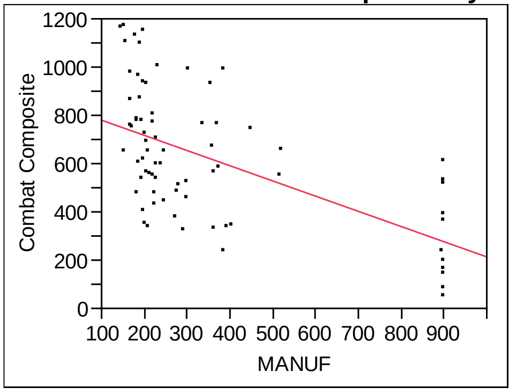
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2676011.5	2676012	70.8986
Error	72	2717582.1	37744	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-35.98354	81.41159	-0.44	0.6598
30-lb. Lifts	8.641096	1.026242	8.42	<.0001

Bivariate Fit of Combat Composite By MANUF



Linear Fit

Combat Composite = 842.05328 - 0.6289532*MANUF

Summary of Fit

RSquare	0.323887
RSquare Adj	0.314496
Root Mean Square Error	225.0519
Mean of Response	622.6081
Observations (or Sum Wgts)	74

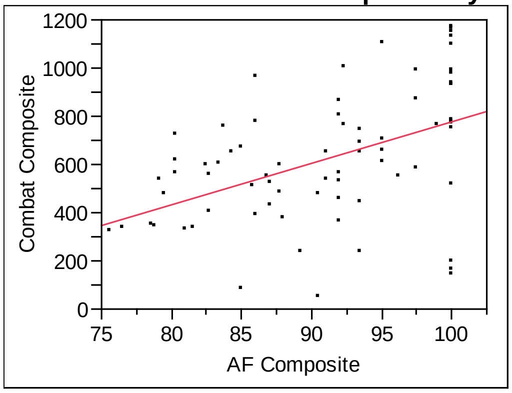
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1746912.9	1746913	34.4910
Error	72	3646680.7	50648	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	842.05328	45.61394	18.46	<.0001
MANUF	-0.628953	0.107094	-5.87	<.0001

Bivariate Fit of Combat Composite By AF Composite



Linear Fit

Combat Composite = -934.093 + 17.110417*AF Composite

Summary of Fit

RSquare	0.215423
RSquare Adj	0.204526
Root Mean Square Error	242.4323
Mean of Response	622.6081
Observations (or Sum Wgts)	74

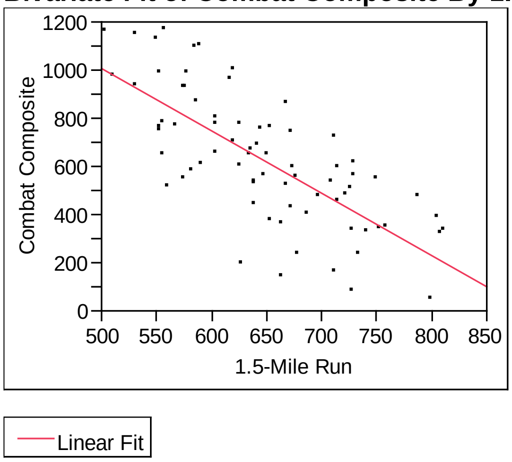
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1161906.2	1161906	19.7692
Error	72	4231687.5	58773	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-934.093	351.247	-2.66	0.0096
AF Composite	17.110417	3.848271	4.45	<.0001

Bivariate Fit of Combat Composite By 1.5-Mile Run



Linear Fit

Combat Composite = 2300.1434 - 2.5856078*1.5-Mile Run

Summary of Fit

RSquare	0.532792
RSquare Adj	0.526303
Root Mean Square Error	187.0802
Mean of Response	622.6081
Observations (or Sum Wgts)	74

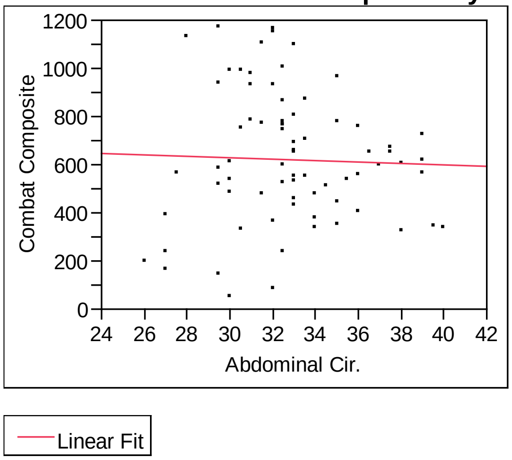
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2873664.8	2873665	82.1070
Error	72	2519928.8	34999	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	2300.1434	186.405	12.34	<.0001
1.5-Mile Run	-2.585608	0.285346	-9.06	<.0001

Bivariate Fit of Combat Composite By Abdominal Cir.



Linear Fit

Combat Composite = 721.25755 - 3.0041393*Abdominal Cir.

Summary of Fit

RSquare	0.001229
RSquare Adj	-0.01264
Root Mean Square Error	273.5305
Mean of Response	622.6081
Observations (or Sum Wgts)	74

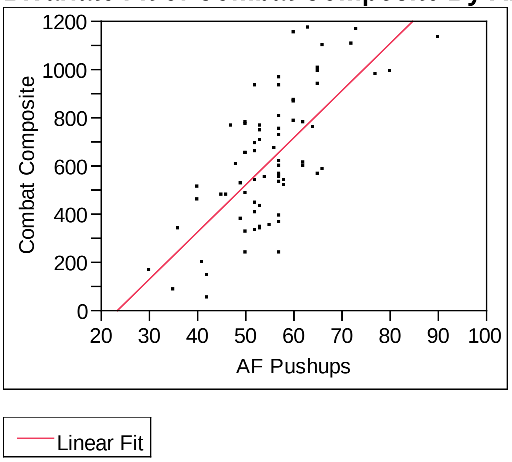
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	6629.2	6629.2	0.0886
Error	72	5386964.4	74818.9	**Prob > F**
C. Total	73	5393593.6		0.7668

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	721.25755	332.9341	2.17	0.0336
Abdominal Cir.	-3.004139	10.09239	-0.30	0.7668

Bivariate Fit of Combat Composite By Air Force Pushups



Linear Fit

Combat Composite = -457.5351 + 19.552495*Air Force Pushups

Summary of Fit

RSquare	0.501523
RSquare Adj	0.4946
Root Mean Square Error	193.2393
Mean of Response	622.6081
Observations (or Sum Wgts)	74

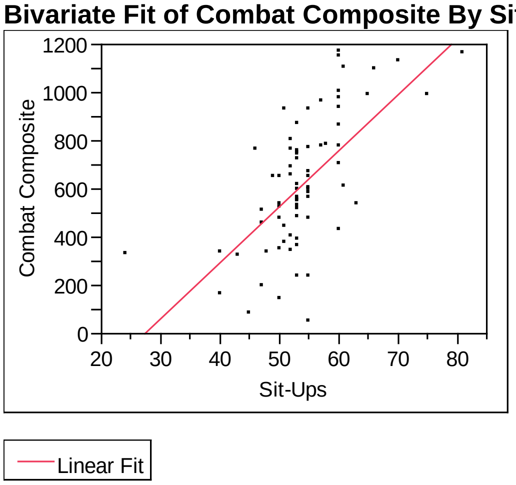
Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2705010.5	2705010	72.4399
Error	72	2688583.2	37341	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-457.5351	128.8817	-3.55	0.0007
Air Force Pushups	19.552495	2.297276	8.51	<.0001

Bivariate Fit of Combat Composite By Sit-Ups



Linear Fit

Combat Composite = -632.1615 + 23.207436*Sit-Ups

Summary of Fit

RSquare	0.416268
RSquare Adj	0.40816
Root Mean Square Error	209.1124
Mean of Response	622.6081
Observations (or Sum Wgts)	74

Analysis of Variance

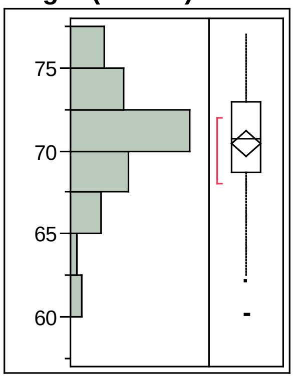
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2245179.2	2245179	51.3442
Error	72	3148414.4	43728	**Prob > F**
C. Total	73	5393593.6		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-632.1615	176.7921	-3.58	0.0006
Sit-Ups	23.207436	3.238779	7.17	<.0001

Appendix N. Variable Distributions

Height (inches)



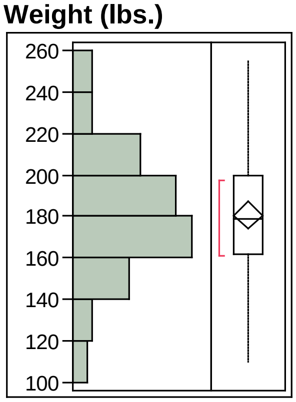
Quantiles

100.0%	maximum	77.000
99.5%		77.000
97.5%		76.463
90.0%		75.000
75.0%	quartile	73.000
50.0%	median	70.750
25.0%	quartile	68.750
10.0%		66.650
2.5%		60.150
0.5%		60.000
0.0%	minimum	60.000

Moments

Mean	70.454268
Std Dev	3.4976024
Std Err Mean	0.3862456
upper 95% Mean	71.222776
lower 95% Mean	69.685761
N	82

Weight (lbs.)



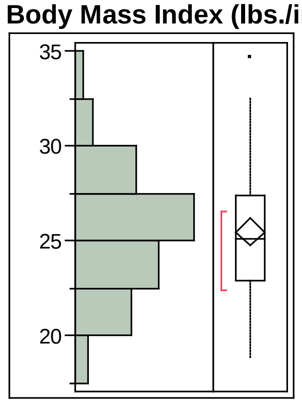
Quantiles

100.0%	maximum	255.00
99.5%		255.00
97.5%		249.63
90.0%		220.50
75.0%	quartile	200.00
50.0%	median	179.00
25.0%	quartile	162.00
10.0%		140.90
2.5%		115.15
0.5%		110.00
0.0%	minimum	110.00

Moments

Mean	180.7439
Std Dev	31.030702
Std Err Mean	3.4267678
upper 95% Mean	187.5621
lower 95% Mean	173.92571
N	82

Body Mass Index (lbs./inches^2)



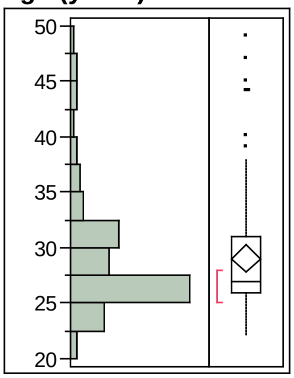
Quantiles

100.0%	maximum	34.580
99.5%		34.580
97.5%		32.490
90.0%		29.878
75.0%	quartile	27.408
50.0%	median	25.150
25.0%	quartile	22.900
10.0%		21.749
2.5%		19.671
0.5%		18.830
0.0%	minimum	18.830

Moments

Mean	25.470732
Std Dev	3.1672977
Std Err Mean	0.3497695
upper 95% Mean	26.166663
lower 95% Mean	24.7748
N	82

Age (years)



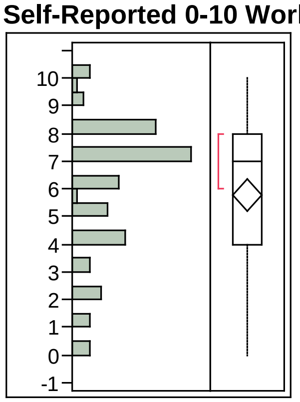
Quantiles

100.0%	maximum	49.000
99.5%		49.000
97.5%		46.650
90.0%		37.300
75.0%	quartile	31.000
50.0%	median	27.000
25.0%	quartile	26.000
10.0%		23.000
2.5%		22.175
0.5%		22.000
0.0%	minimum	22.000

Moments

Mean	29.034884
Std Dev	5.6847529
Std Err Mean	0.6130027
upper 95% Mean	30.253697
lower 95% Mean	27.81607
N	86

Self-Reported 0-10 Workout Variation



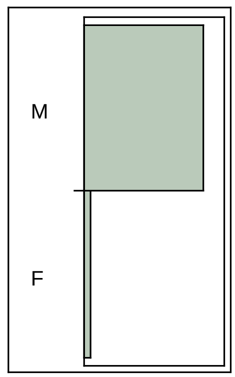
Quantiles

100.0%	maximum	10.000
99.5%		10.000
97.5%		10.000
90.0%		8.000
75.0%	quartile	8.000
50.0%	median	7.000
25.0%	quartile	4.000
10.0%		2.000
2.5%		0.000
0.5%		0.000
0.0%	minimum	0.000

Moments

Mean	5.7820513
Std Dev	2.5040094
Std Err Mean	0.2835232
upper 95% Mean	6.3466182
lower 95% Mean	5.2174844
N	78

Sex

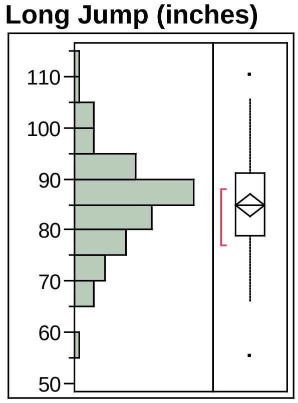


Frequencies

Level	Count	Prob
F	5	0.05814
M	81	0.94186
Total	86	1.00000

N Missing
0
2 Levels

Long Jump (inches)



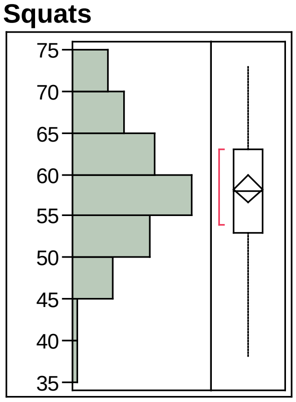
Quantiles

100.0%	maximum	110.00
99.5%		110.00
97.5%		105.75
90.0%		95.80
75.0%	quartile	91.00
50.0%	median	85.00
25.0%	quartile	79.00
10.0%		73.00
2.5%		66.10
0.5%		55.00
0.0%	minimum	55.00

Moments

Mean	84.814815
Std Dev	9.4803891
Std Err Mean	1.0533766
upper 95% Mean	86.911101
lower 95% Mean	82.718529
N	81

Squats



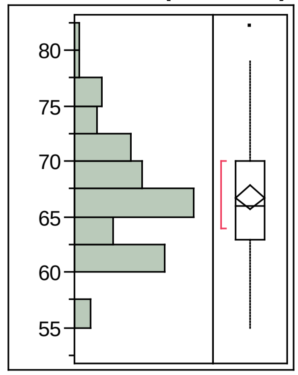
Quantiles

100.0%	maximum	73.000
99.5%		73.000
97.5%		72.950
90.0%		69.000
75.0%	quartile	63.000
50.0%	median	58.000
25.0%	quartile	53.000
10.0%		49.000
2.5%		44.150
0.5%		38.000
0.0%	minimum	38.000

Moments

Mean	58.283951
Std Dev	7.431747
Std Err Mean	0.8257497
upper 95% Mean	59.927245
lower 95% Mean	56.640656
N	81

Shuttle Run (seconds)



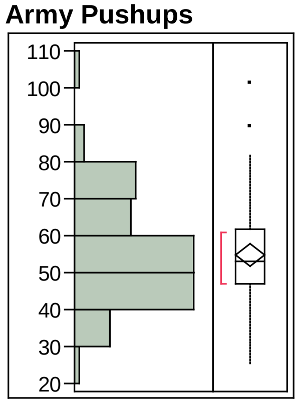
Quantiles

100.0%	maximum	82.000
99.5%		82.000
97.5%		78.950
90.0%		73.000
75.0%	quartile	70.000
50.0%	median	66.000
25.0%	quartile	63.000
10.0%		61.000
2.5%		57.000
0.5%		55.000
0.0%	minimum	55.000

Moments

Mean	66.7625
Std Dev	5.1317916
Std Err Mean	0.5737517
upper 95% Mean	67.904524
lower 95% Mean	65.620476
N	80

Army Pushups



Quantiles

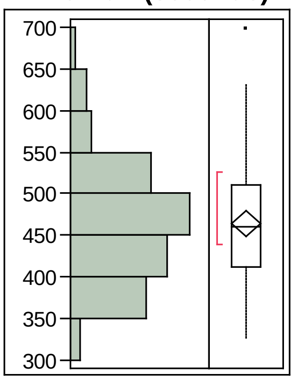
100.0%	maximum	101.00
99.5%		101.00
97.5%		88.82
90.0%		74.80
75.0%	quartile	61.75
50.0%	median	53.00

25.0%	quartile	47.00
10.0%		38.20
2.5%		32.03
0.5%		25.00
0.0%	minimum	25.00

Moments

Mean	54.7625
Std Dev	13.904051
Std Err Mean	1.5545201
upper 95% Mean	57.856695
lower 95% Mean	51.668305
N	80

1-Mile Run (seconds)



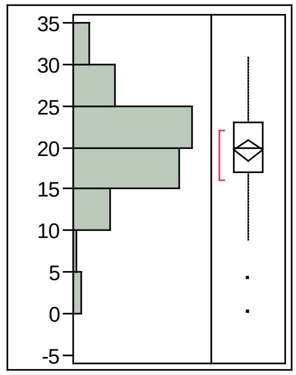
Quantiles

100.0%	maximum	697.00
99.5%		697.00
97.5%		633.00
90.0%		552.00
75.0%	quartile	510.00
50.0%	median	461.00
25.0%	quartile	413.00
10.0%		365.00
2.5%		342.00
0.5%		328.00
0.0%	minimum	328.00

Moments

Mean	464.1519
Std Dev	71.98381
Std Err Mean	8.0988114
upper 95% Mean	480.27539
lower 95% Mean	448.0284
N	79

Heel Hooks



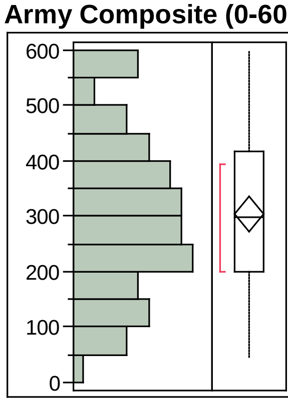
Quantiles

100.0%	maximum	31.000
99.5%		31.000
97.5%		30.000
90.0%		28.000
75.0%	quartile	23.000
50.0%	median	20.000
25.0%	quartile	17.000
10.0%		13.000
2.5%		4.000
0.5%		0.000
0.0%	minimum	0.000

Moments

Mean	19.696203
Std Dev	5.648586
Std Err Mean	0.6355156
upper 95% Mean	20.961417
lower 95% Mean	18.430988
N	79

Army Composite (0-600)



Quantiles

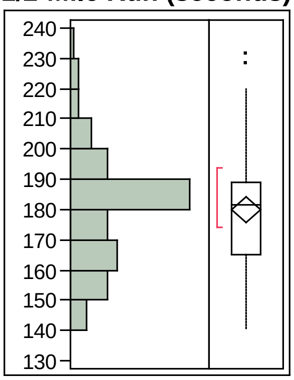
100.0%	maximum	596.00
99.5%		596.00
97.5%		591.00
90.0%		505.00
75.0%	quartile	416.00
50.0%	median	299.00

25.0%	quartile	201.00
10.0%		111.00
2.5%		57.00
0.5%		43.00
0.0%	minimum	43.00

Moments

Mean	304.48101
Std Dev	142.53536
Std Err Mean	16.036481
upper 95% Mean	336.40719
lower 95% Mean	272.55483
N	79

1/2-Mile Run (seconds)



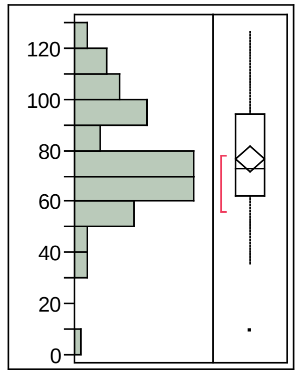
Quantiles

100.0%	maximum	231.00
99.5%		231.00
97.5%		227.80
90.0%		204.90
75.0%	quartile	189.00
50.0%	median	181.50
25.0%	quartile	165.00
10.0%		153.10
2.5%		143.10
0.5%		140.00
0.0%	minimum	140.00

Moments

Mean	179.8375
Std Dev	19.041224
Std Err Mean	2.1288735
upper 95% Mean	184.07492
lower 95% Mean	175.60008
N	80

30-lb. Lifts



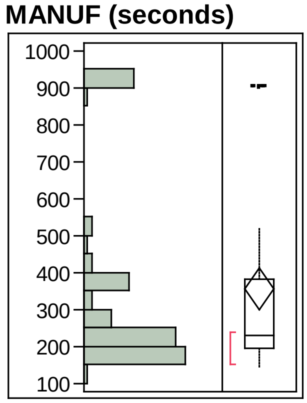
Quantiles

100.0%	maximum	127.00
99.5%		127.00
97.5%		124.00
90.0%		105.00
75.0%	quartile	94.00
50.0%	median	73.00
25.0%	quartile	62.00
10.0%		51.00
2.5%		35.00
0.5%		9.00
0.0%	minimum	9.00

Moments

Mean	76.468354
Std Dev	22.273841
Std Err Mean	2.5060029
upper 95% Mean	81.457423
lower 95% Mean	71.479286
N	79

MANUF (seconds)



NOTE: 900 seconds = Did Not Finish

Quantiles

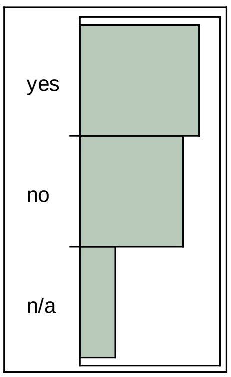
100.0%	maximum	900.00
99.5%		900.00
97.5%		900.00
90.0%		900.00

75.0%	quartile	384.25
50.0%	median	231.00
25.0%	quartile	196.50
10.0%		169.90
2.5%		150.83
0.5%		144.00
0.0%	minimum	144.00

Moments

Mean	355.15385
Std Dev	248.33843
Std Err Mean	28.11879
upper 95% Mean	411.14551
lower 95% Mean	299.16218
N	78

MANUF Grenade Hit?

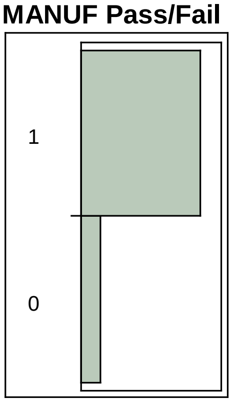


Frequencies

Level	Count	Prob
n/a	11	0.14103
no	31	0.39744
yes	36	0.46154
Total	78	1.00000

N Missing
8
3 Levels

MANUF Pass/Fail

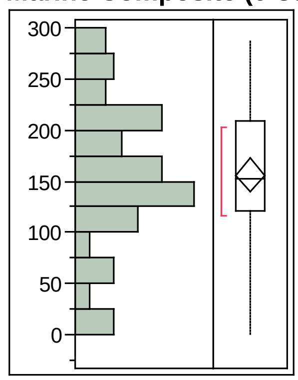


Frequencies

Level	Count	Prob
0 (fail)	11	0.14103
1 (pass)	67	0.85897
Total	78	1.00000

N Missing
8
2 Levels

Marine Composite (0-300)



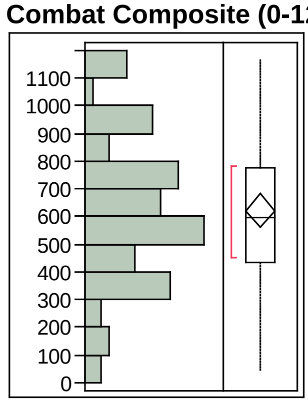
Quantiles

100.0%	maximum	288.00
99.5%		288.00
97.5%		287.03
90.0%		265.30
75.0%	quartile	209.25
50.0%	median	152.00
25.0%	quartile	120.75
10.0%		53.00
2.5%		0.00
0.5%		0.00
0.0%	minimum	0.00

Moments

Mean	156.17949
Std Dev	72.946831
Std Err Mean	8.2596021
upper 95% Mean	172.62646
lower 95% Mean	139.73252
N	78

Combat Composite (0-1200)



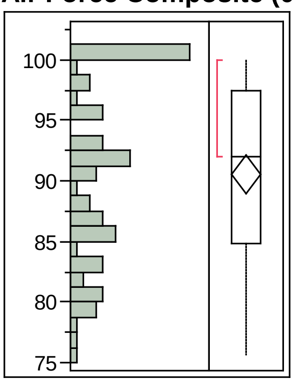
Quantiles

100.0%	maximum	1165.0
99.5%		1165.0
97.5%		1161.5
90.0%		994.0
75.0%	quartile	774.3
50.0%	median	597.5
25.0%	quartile	434.5
10.0%		274.5
2.5%		75.3
0.5%		49.0
0.0%	minimum	49.0

Moments

Mean	622.60811
Std Dev	271.81767
Std Err Mean	31.598162
upper 95% Mean	685.58315
lower 95% Mean	559.63306
N	74

Air Force Composite (0-100)



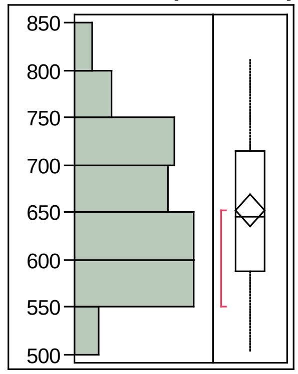
Quantiles

100.0%	maximum	100.00
99.5%		100.00
97.5%		100.00
90.0%		100.00
75.0%	quartile	97.50
50.0%	median	92.00
25.0%	quartile	84.83
10.0%		80.30
2.5%		76.65
0.5%		75.60
0.0%	minimum	75.60

Moments

Mean	90.507317
Std Dev	7.3254887
Std Err Mean	0.8089649
upper 95% Mean	92.116903
lower 95% Mean	88.897731
N	82

1.5-Mile Run (seconds)



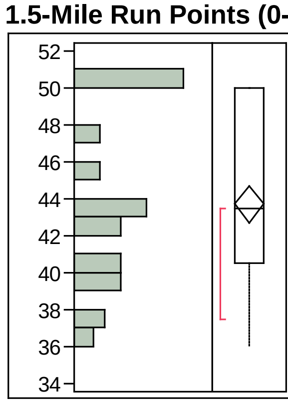
Quantiles

100.0%	maximum	811.00
99.5%		811.00
97.5%		807.78
90.0%		751.40
75.0%	quartile	715.00
50.0%	median	646.00
25.0%	quartile	588.25
10.0%		552.90
2.5%		511.50
0.5%		503.00
0.0%	minimum	503.00

Moments

Mean	651.85366
Std Dev	75.948183
Std Err Mean	8.3870737
upper 95% Mean	668.5413
lower 95% Mean	635.16601
N	82

1.5-Mile Run Points (0-50)



Quantiles

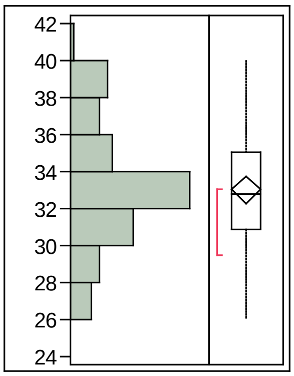
100.0%	maximum	50.000
99.5%		50.000
97.5%		50.000
90.0%		50.000
75.0%	quartile	50.000

50.0%	median	43.500
25.0%	quartile	40.500
10.0%		37.500
2.5%		36.000
0.5%		36.000
0.0%	minimum	36.000

Moments

Mean	43.707317
Std Dev	4.5805218
Std Err Mean	0.505834
upper 95% Mean	44.713768
lower 95% Mean	42.700866
N	82

Abdominal Circumference (inches)



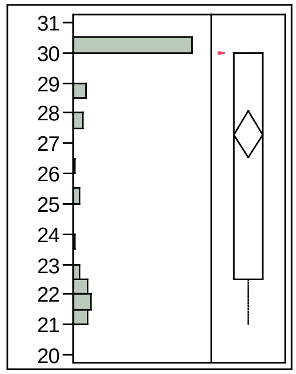
Quantiles

100.0%	maximum	40.000
99.5%		40.000
97.5%		39.463
90.0%		38.000
75.0%	quartile	35.000
50.0%	median	32.750
25.0%	quartile	30.875
10.0%		29.500
2.5%		27.000
0.5%		26.000
0.0%	minimum	26.000

Moments

Mean	33.006098
Std Dev	3.241793
Std Err Mean	0.3579961
upper 95% Mean	33.718398
lower 95% Mean	32.293798
N	82

Abdominal Circumference Points (0-30)



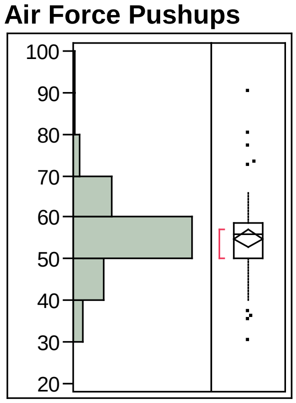
Quantiles

100.0%	maximum	30.000
99.5%		30.000
97.5%		30.000
90.0%		30.000
75.0%	quartile	30.000
50.0%	median	30.000
25.0%	quartile	22.500
10.0%		21.600
2.5%		21.254
0.5%		21.000
0.0%	minimum	21.000

Moments

Mean	27.303049
Std Dev	3.5837799
Std Err Mean	0.3957623
upper 95% Mean	28.090492
lower 95% Mean	26.515606
N	82

Air Force Pushups



Quantiles

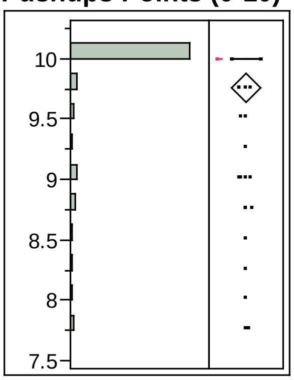
100.0%	maximum	90.000
99.5%		90.000
97.5%		79.775
90.0%		65.000
75.0%	quartile	58.500

50.0%	median	56.000
25.0%	quartile	50.000
10.0%		42.000
2.5%		35.075
0.5%		30.000
0.0%	minimum	30.000

Moments

Mean	54.963415
Std Dev	9.629488
Std Err Mean	1.0633991
upper 95% Mean	57.079245
lower 95% Mean	52.847584
N	82

Pushups Points (0-10)



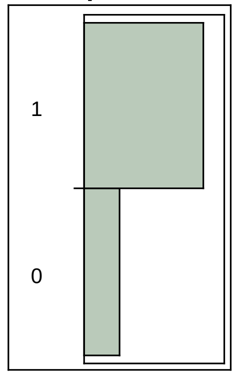
Quantiles

100.0%	maximum	10.000
99.5%		10.000
97.5%		10.000
90.0%		10.000
75.0%	quartile	10.000
50.0%	median	10.000
25.0%	quartile	10.000
10.0%		8.825
2.5%		7.769
0.5%		7.750
0.0%	minimum	7.750

Moments

Mean	9.7530488
Std Dev	0.5492614
Std Err Mean	0.0606558
upper 95% Mean	9.8737348
lower 95% Mean	9.6323628
N	82

Pushups Max/No Max

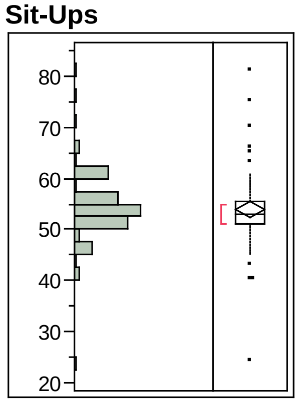


Frequencies

Level	Count	Prob
0 (no max)	19	0.23171
1 (max)	63	0.76829
Total	82	1.00000

N Missing
4
2 Levels

Sit-Ups



Quantiles

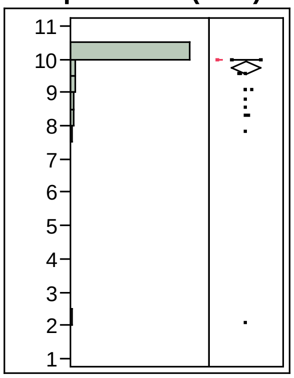
100.0%	maximum	81.000
99.5%		81.000
97.5%		74.625
90.0%		60.700
75.0%	quartile	55.500
50.0%	median	53.000
25.0%	quartile	51.000
10.0%		47.000
2.5%		40.000
0.5%		24.000
0.0%	minimum	24.000

Moments

Mean	53.865854
Std Dev	7.2346256
Std Err Mean	0.7989307
upper 95% Mean	55.455475
lower 95% Mean	52.276232

N	82	N Missing 4
		2 Levels

Sit-Ups Points (0-10)



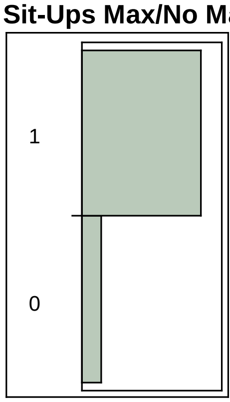
Quantiles

100.0%	maximum	10.000
99.5%		10.000
97.5%		10.000
90.0%		10.000
75.0%	quartile	10.000
50.0%	median	10.000
25.0%	quartile	10.000
10.0%		9.000
2.5%		7.788
0.5%		2.000
0.0%	minimum	2.000

Moments

Mean	9.7439024
Std Dev	0.9773481
Std Err Mean	0.10793
upper 95% Mean	9.9586494
lower 95% Mean	9.5291555
N	82

Sit-Ups Max/No Max



Frequencies

Level	Count	Prob
0 (no max)	12	0.14634
1 (max)	70	0.85366
Total	82	1.00000

Appendix O. Tabulated Data

Marking	AFSC	HSQ	ICD	APRT date	MCFT date	Height	Z	%	Weight	Z	%	BMI	Z	%
B6291	32E	yes	yes	28-Oct-08	4-Nov-08	70	-0.13	0.45	150	-0.991	0.16	21.52	-1.247	0.11
H5602	32E	yes	yes	28-Oct-08	4-Nov-08	71.5	0.299	0.62	162.8	-0.578	0.28	22.39	-0.973	0.17
C4808	32E	yes	yes	28-Oct-08	4-Nov-08	67.5	-0.84	0.20	176.8	-0.127	0.45	27.28	0.5711	0.72
S6073	32E	yes	yes	28-Oct-08	4-Nov-08	64	-1.85	0.03	132	-1.571	0.06	22.66	-0.889	0.19
H5390	32E	yes	yes	28-Oct-08	4-Nov-08	68	-0.7	0.24	192.5	0.379	0.65	29.27	1.1985	0.88
W7652	32E	yes	yes	28-Oct-08	4-Nov-08	73	0.728	0.77	197.1	0.527	0.70	26.00	0.1677	0.57
G5717	32E	yes	yes	28-Oct-08	4-Nov-08	74	1.014	0.84	222	1.33	0.91	28.50	0.9566	0.83
T3935	32E	yes	yes	28-Oct-08	4-Nov-08	70	-0.13	0.45	165.2	-0.501	0.31	23.70	-0.559	0.29
M4991	32E	yes	yes	28-Oct-08	4-Nov-08	70	-0.13	0.45	175.6	-0.166	0.43	25.19	-0.087	0.47
P7178	62E	yes	yes	18-Nov-08	25-Nov-08	67	-0.99	0.16	172	-0.282	0.39	26.94	0.4628	0.68
G2975	62E	yes	yes	18-Nov-08	25-Nov-08	73	0.728	0.77	200	0.621	0.73	26.38	0.2885	0.61
R1870	62E	yes	yes	18-Nov-08	25-Nov-08	71	0.156	0.56	161	-0.636	0.26	22.45	-0.953	0.17
S4390	62E	yes	yes	18-Nov-08	25-Nov-08	60	-2.99	0.00	117	-2.054	0.02	22.85	-0.828	0.20
W0506	62E	yes	yes	18-Nov-08	25-Nov-08	70	-0.13	0.45	174	-0.217	0.41	24.96	-0.16	0.44
S2374	33S	yes	yes	4-Dec-08	25-Nov-08	74	1.014	0.84	185	0.137	0.55	23.75	-0.543	0.29
W4245	62E	yes	yes	25-Nov-08	2-Dec-08	75	1.3	0.90	205.5	0.798	0.79	25.68	0.0671	0.53
H8781	33S	yes	yes	19-Nov-08	2-Dec-08	67	-0.99	0.16	150	-0.991	0.16	23.49	-0.625	0.27
C3523	62E	yes	yes	25-Nov-08	2-Dec-08	72	0.442	0.67	230	1.587	0.94	31.19	1.8059	0.96
W1482	62E	yes	yes	25-Nov-08	2-Dec-08	77	1.871	0.97	250	2.232	0.99	29.64	1.3173	0.91
C4922	62E	yes	yes	25-Nov-08	2-Dec-08	73	0.728	0.77	216	1.136	0.87	28.49	0.9549	0.83
D7893	62E	yes	yes	25-Nov-08	2-Dec-08	70	-0.13	0.45	140	-1.313	0.09	20.09	-1.7	0.04
J4197	61E	yes	yes	25-Nov-08	2-Dec-08	72	0.442	0.67	145	-1.152	0.12	19.66	-1.833	0.03
B5875	62E	yes	yes	25-Nov-08	16-Jan-09	75	1.3	0.90	245	2.071	0.98	30.62	1.6258	0.95
C7367	62E	yes	yes	25-Nov-08										
W3437	32E	yes	yes	28-Oct-08	4-Nov-08	70.5	0.013	0.51	212	1.007	0.84	29.99	1.4256	0.92
C9543	32E	yes	yes	3-Nov-08	10-Nov-08	71	0.156	0.56	164	-0.54	0.29	22.87	-0.821	0.21
M9969	32E	yes	yes	3-Nov-08	10-Nov-08	70	-0.13	0.45	169	-0.378	0.35	24.25	-0.386	0.35
M6370	32E	yes	yes	3-Nov-08	10-Nov-08	66.5	-1.13	0.13	164	-0.54	0.29	26.07	0.1896	0.58
T1022	32E	yes	yes	3-Nov-08	10-Nov-08	72	0.442	0.67	240	1.91	0.97	32.55	2.2341	0.99
D9035	32E	yes	yes	3-Nov-08	10-Nov-08	69	-0.42	0.34	190	0.298	0.62	28.06	0.8161	0.79
F7251	32E	yes	yes	3-Nov-08	10-Nov-08	74.75	1.228	0.89	196.5	0.508	0.69	24.72	-0.236	0.41
O8961	32E	yes	yes	3-Nov-08	10-Nov-08	72	0.442	0.67	185	0.137	0.55	25.09	-0.121	0.45
O4718	32E	yes	yes	3-Nov-08	10-Nov-08	68	-0.7	0.24	173	-0.25	0.40	26.30	0.2625	0.60
H7774	32E	yes	yes	3-Nov-08	10-Nov-08	76.5	1.729	0.96	212	1.007	0.84	25.47	-0.001	0.50
M3614	32E	yes	yes	3-Nov-08		73	0.728	0.77	217	1.168	0.88	28.63	0.9965	0.84
G7847	3NO	yes	yes	14-Jan-09	10-Nov-08	62	-2.42	0.01	120	-1.958	0.03	21.95	-1.113	0.13
M5998	32E	yes	yes	3-Nov-08		67	-0.99	0.16	180	-0.024	0.49	28.19	0.8583	0.80
L5802	62E	yes	yes	19-Nov-08	3-Dec-08	68	-0.7	0.24	178	-0.088	0.46	27.06	0.5025	0.69
D2647	62E	yes	yes	19-Nov-08	3-Dec-08	69	-0.42	0.34	170	-0.346	0.36	25.10	-0.116	0.45
M5081	62E	yes	yes	19-Nov-08	3-Dec-08	66	-1.27	0.10	135	-1.474	0.07	21.79	-1.163	0.12
B5242	62E	yes	yes	19-Nov-08	3-Dec-08	69	-0.42	0.34	150	-0.991	0.16	22.15	-1.049	0.15
S7071	62E	yes	yes	19-Nov-08										
B7363	63A	yes	yes	24-Nov-08	17-Nov-08	73	0.728	0.77	199	0.588	0.72	26.25	0.2468	0.60
M6250	14N	yes	yes	24-Nov-08	17-Nov-08	69	-0.42	0.34	157	-0.765	0.22	23.18	-0.722	0.24
S8170	63A	yes	yes	24-Nov-08	17-Nov-08	72	0.442	0.67	180	-0.024	0.49	24.41	-0.335	0.37
W7224	62E	yes	yes	24-Nov-08	17-Nov-08	60	-2.99	0.00	115	-2.119	0.02	22.46	-0.951	0.17
F1550	63A	yes	yes	24-Nov-08	17-Nov-08	70	-0.13	0.45	170	-0.346	0.36	24.39	-0.341	0.37
T1569	4BO	yes	yes	5-Nov-08	12-Nov-08	71	0.156	0.56	193	0.395	0.65	26.92	0.4562	0.68
C4822	4BO	yes	yes	5-Nov-08	12-Nov-08	71	0.156	0.56	215	1.104	0.87	29.98	1.4248	0.92
R6465	4BO	yes	yes	5-Nov-08	12-Nov-08	69	-0.42	0.34	187	0.202	0.58	27.61	0.6762	0.75
F6822	4BO	yes	yes	5-Nov-08	12-Nov-08	69	-0.42	0.34	215	1.104	0.87	31.75	1.9816	0.98
S0701	43E	yes	yes	5-Nov-08	12-Nov-08	68	-0.7	0.24	178	-0.088	0.46	27.06	0.5025	0.69

Marking	AFSC	HSQ	ICD	APRT date	MCFT date	Height	Z	%	Weight	Z	%	BMI	Z	%
O5519	4BO	yes	yes	5-Nov-08	12-Nov-08	67	-0.99	0.16	155	-0.83	0.20	24.27	-0.378	0.35
S4148	32E	yes	yes	7-Nov-08	14-Nov-08	74	1.014	0.84	225	1.426	0.92	28.89	1.0782	0.86
C2754	32E	yes	yes	7-Nov-08	16-Jan-09	70	-0.13	0.45	185	0.137	0.55	26.54	0.3383	0.63
D7810	32E	yes	yes	7-Nov-08	14-Nov-08	72	0.442	0.67	154	-0.862	0.19	20.88	-1.448	0.07
K4493	32E	yes	yes	7-Nov-08		75.5	1.443	0.93	228	1.523	0.94	28.12	0.8362	0.80
G2698	32E	yes	yes		14-Nov-08									
P4825	32E	yes	yes	7-Nov-08	14-Nov-08	69	-0.42	0.34	165	-0.507	0.31	24.36	-0.349	0.36
L4008	32E	yes	yes	7-Nov-08	14-Nov-08	74.5	1.157	0.88	194	0.427	0.67	24.57	-0.284	0.39
P7599	32E	yes	yes	4-Feb-09	14-Nov-08	73	0.728	0.77	165	-0.507	0.31	21.77	-1.169	0.12
W0142	32E	yes	yes	7-Nov-08	14-Nov-08	75	1.3	0.90	212	1.007	0.84	26.50	0.3236	0.63
H0975	3CO	yes	yes	7-Nov-08	14-Nov-08	68	-0.7	0.24	185	0.137	0.55	28.13	0.8385	0.80
G5491	32E	yes	yes	7-Nov-08	14-Nov-08	75	1.3	0.90	187	0.202	0.58	23.37	-0.663	0.25
T8117	61SD	yes	yes		12-Nov-08	72	0.442	0.67	196	0.492	0.69	26.58	0.3502	0.64
T7266	62E	yes	yes	14-Jan-09	12-Nov-08	72	0.442	0.67	255	2.393	0.99	34.58	2.8763	1.00
L7674	62E	yes	yes		12-Nov-08	71	0.156	0.56	135	-1.474	0.07	18.83	-2.098	0.02
G2835	62E	yes	yes	19-Nov-08	12-Nov-08	70	-0.13	0.45	175	-0.185	0.43	25.11	-0.115	0.45
E8412	62E	yes	yes	19-Nov-08	12-Nov-08	71	0.156	0.56	185	0.137	0.55	25.80	0.1039	0.54
G7630	62E	yes	yes	19-Nov-08	12-Nov-08	70.5	0.013	0.51	162	-0.604	0.27	22.91	-0.807	0.21
L5409	62E	yes	yes	19-Nov-08	12-Nov-08	68	-0.7	0.24	143	-1.216	0.11	21.74	-1.178	0.12
N5969	62E	yes	yes	19-Nov-08	12-Nov-08	72	0.442	0.67	155	-0.83	0.20	21.02	-1.405	0.08
P4801	62E	yes	yes	19-Nov-08	12-Nov-08	73	0.728	0.77	210	0.943	0.83	27.70	0.705	0.76
S8868	62E	yes	yes	19-Nov-08	12-Nov-08	67	-0.99	0.16	162	-0.604	0.27	25.37	-0.032	0.49
J2723	62E	yes	yes	19-Nov-08	12-Nov-08	74	1.014	0.84	210	0.943	0.83	26.96	0.4702	0.68
C7189	61S	yes	yes	13-Jan-09	6-Jan-09	70	-0.13	0.45	155	-0.83	0.20	22.24	-1.021	0.15
B5401	62E	yes	yes	13-Jan-09	6-Jan-09	69	-0.42	0.34	170	-0.346	0.36	25.10	-0.116	0.45
F3358	13S	yes	yes	13-Jan-09	6-Jan-09	74	1.014	0.84	213	1.039	0.85	27.34	0.5918	0.72
I9991	11S	yes	yes	13-Jan-09	6-Jan-09	71	0.156	0.56	165	-0.507	0.31	23.01	-0.777	0.22
L9118	62E	yes	yes		6-Jan-09									
L4216	38M	yes	yes	4-Feb-09	7-Jan-09	71	0.156	0.56	187	0.202	0.58	26.08	0.192	0.58
S7278	31P	yes	yes	4-Feb-09	7-Jan-09	75	1.3	0.90	200	0.621	0.73	25.00	-0.15	0.44
O5892	11M	yes	yes	21-Jan-09	7-Jan-09	76	1.586	0.94	185	0.137	0.55	22.52	-0.933	0.18
R0404	62E	yes	yes		7-Jan-09	70	-0.13	0.45	175	-0.185	0.43	25.11	-0.115	0.45
H6001	9G0	yes	yes	4-Feb-09	7-Jan-09	65	-1.56	0.06	189	0.266	0.60	31.45	1.8873	0.97
L4872	43D	yes	yes	4-Feb-09	7-Jan-09	62.5	-2.27	0.01	110	-2.28	0.01	19.80	-1.791	0.04

Marking	Age	Z	%	0-10 Variation	Z	%	Sex	Long Jump	Z	%	Points
B6291	25	-0.71	0.24	7	0.486	0.69	M	71	-1.46	0.07	0
H5602	24	-0.89	0.19	5	-0.312	0.38	M	73	-1.25	0.11	1
C4808	23	-1.06	0.14	7	0.486	0.69	M	83	-0.19	0.42	41
S6073	24	-0.89	0.19	8	0.886	0.81	M	94	0.969	0.83	92
H5390	25	-0.71	0.24	10	1.684	0.95	M	96	1.18	0.88	98
W7652	23	-1.06	0.14	6	0.087	0.53	M	100	1.602	0.95	100
G5717	23	-1.06	0.14	2	-1.51	0.07	M	81	-0.4	0.34	30
T3935	23	-1.06	0.14	8	0.886	0.81	M	101	1.707	0.96	100
M4991	23	-1.06	0.14	9	1.285	0.90	M	101	1.707	0.96	100
P7178	27	-0.36	0.36	3	-1.111	0.13	M	85	0.02	0.51	51
G2975	31	0.346	0.64	0	-2.309	0.01	M	94	0.969	0.83	92
R1870	26	-0.53	0.30	8	0.886	0.81	M	81	-0.4	0.34	30
S4390	26	-0.53	0.30	8	0.886	0.81	F	73	-1.25	0.11	1
W0506	38	1.577	0.94	7	0.486	0.69	M	83	-0.19	0.42	41
S2374	31	0.346	0.64	8	0.886	0.81	M	94	0.969	0.83	92
W4245	27	-0.36	0.36	7	0.486	0.69	M	94	0.969	0.83	92
H8781	25	-0.71	0.24	0	-2.309	0.01	M	78	-0.72	0.24	17
C3523	32	0.522	0.70	4	-0.712	0.24	M	80	-0.51	0.31	26
W1482	30	0.17	0.57	4	-0.712	0.24	M	79	-0.61	0.27	21
C4922	27	-0.36	0.36	7	0.486	0.69	M	87	0.23	0.59	61

Marking	Age	Z	%	0-10 Variation	Z	%	Sex	Long Jump	Z	%	Points
D7893	28	-0.18	0.43	6	0.087	0.53	M	95	1.074	0.86	95
J4197	27	-0.36	0.36	6	0.087	0.53	M	86	0.125	0.55	56
B5875	27	-0.36	0.36	4	-0.712	0.24	M	84	-0.09	0.47	46
C7367	26	-0.53	0.30				M	73	-1.25	0.11	1
W3437	27	-0.36	0.36	8	0.886	0.81	M	82	-0.3	0.38	35
C9543	26	-0.53	0.30	2	-1.51	0.07	M	78	-0.72	0.24	17
M9969	28	-0.18	0.43	5	-0.312	0.38	M	93	0.863	0.81	88
M6370	26	-0.53	0.30	1	-1.91	0.03	M	85	0.02	0.51	51
T1022	26	-0.53	0.30	5	-0.312	0.38	M	95	1.074	0.86	95
D9035	27	-0.36	0.36	10	1.684	0.95	M	97	1.285	0.90	100
F7251	30	0.17	0.57	3	-1.111	0.13	M	86	0.125	0.55	56
O8961	31	0.346	0.64	4	-0.712	0.24	M	77	-0.82	0.20	13
O4718	26	-0.53	0.30	4	-0.712	0.24	M	74	-1.14	0.13	3
H7774	30	0.17	0.57	0	-2.309	0.01	M	85	0.02	0.51	51
M3614	29	-0.01	0.50				M	80	-0.51	0.31	26
G7847	26	-0.53	0.30	8	0.886	0.81	F	68	-1.77	0.04	0
M5998	28	-0.18	0.43	6	0.087	0.53	M	80	-0.51	0.31	26
L5802	32	0.522	0.70	8	0.886	0.81	M	88	0.336	0.63	66
D2647	27	-0.36	0.36	5	-0.312	0.38	M	93	0.863	0.81	88
M5081	22	-1.24	0.11	4	-0.712	0.24	M	77	-0.82	0.20	13
B5242	28	-0.18	0.43	9	1.285	0.90	M	70	-1.56	0.06	0
S7071	30	0.17	0.57				M	79	-0.61	0.27	21
B7363	27	-0.36	0.36	7	0.486	0.69	M	75	-1.04	0.15	6
M6250	36	1.225	0.89	2	-1.51	0.07	M	90	0.547	0.71	76
S8170	47	3.16	1.00	8	0.886	0.81	M	86	0.125	0.55	56
W7224	23	-1.06	0.14	8	0.886	0.81	F	69	-1.67	0.05	0
F1550	32	0.522	0.70	4	-0.712	0.24	M	89	0.441	0.67	71
T1569	28	-0.18	0.43	1	-1.91	0.03	M	86	0.125	0.55	56
C4822	26	-0.53	0.30	7	0.486	0.69	M	83	-0.19	0.42	41
R6465	26	-0.53	0.30	5	-0.312	0.38	M	83	-0.19	0.42	41
F6822	23	-1.06	0.14	6	0.087	0.53	M	94	0.969	0.83	92
S0701	25	-0.71	0.24	7	0.486	0.69	M	76	-0.93	0.18	10
O5519	30	0.17	0.57	7	0.486	0.69	F	66	-1.98	0.02	0
S4148	25	-0.71	0.24	7	0.486	0.69	M	87	0.23	0.59	61
C2754	28	-0.18	0.43	4	-0.712	0.24	M	89	0.441	0.67	71
D7810	31	0.346	0.64	1	-1.91	0.03	M	75	-1.04	0.15	6
K4493	33	0.698	0.76	7	0.486	0.69	M	82	-0.3	0.38	35
G2698	27	-0.36	0.36				M				
P4825	28	-0.18	0.43	2	-1.51	0.07	M	84	-0.09	0.47	46
L4008	32	0.522	0.70	7	0.486	0.69	M	110	2.657	1.00	100
P7599	31	0.346	0.64	4	-0.712	0.24	M	82	-0.3	0.38	35
W0142	24	-0.89	0.19	2	-1.51	0.07	M	85	0.02	0.51	51
H0975	34	0.873	0.81	7	0.486	0.69	M	69	-1.67	0.05	0
G5491	27	-0.36	0.36	7	0.486	0.69	M	100	1.602	0.95	100
T8117	25	-0.71	0.24				M				
T7266	26	-0.53	0.30	6	0.087	0.53	M	80	-0.51	0.31	26
L7674	28	-0.18	0.43				M				
G2835	26	-0.53	0.30				M	87	0.23	0.59	61
E8412	22	-1.24	0.11	9.5	1.485	0.93	M	106	2.235	0.99	100
G7630	27	-0.36	0.36	7	0.486	0.69	M	87	0.23	0.59	61
L5409	26	-0.53	0.30	7	0.486	0.69	M	88	0.336	0.63	66
N5969	26	-0.53	0.30	6	0.087	0.53	M	89	0.441	0.67	71
P4801	28	-0.18	0.43	7	0.486	0.69	M	88	0.336	0.63	66
S8868	26	-0.53	0.30	5.5	-0.113	0.46	M	85	0.02	0.51	51
J2723	28	-0.18	0.43	3	-1.111	0.13	M	87	0.23	0.59	61
C7189	26	-0.53	0.30	8	0.886	0.81	M	91	0.652	0.74	80

Marking	Age	Z	%	0-10 Variation	Z	%	Sex	Long Jump	Z	%	Points
B5401	34	0.873	0.81	8	0.886	0.81	M	92	0.758	0.78	84
F3358	44	2.633	1.00	5	-0.312	0.38	M	91	0.652	0.74	80
I9991	37	1.401	0.92	8	0.886	0.81	M	85	0.02	0.51	51
L9118	33	0.698	0.76				M				
L4216	39	1.753	0.96	7	0.486	0.69	M	86	0.125	0.55	56
S7278	45	2.808	1.00	10	1.684	0.95	M	93	0.863	0.81	88
O5892	40	1.929	0.97	6	0.087	0.53	M	89	0.441	0.67	71
R0404	35	1.049	0.85	7	0.486	0.69	M				
H6001	49	3.512	1.00	7	0.486	0.69	M	78	-0.72	0.24	17
L4872	44	2.633	1.00	8	0.886	0.81	F	55	-3.14	0.00	0

Marking	Squats	Z	%	Points	Shuttle Run	Z	%	Points	Army Pushups	Z	%	Points
B6291	51	-0.98	0.16	8	66	0.1486	0.56	57	71	1.17	0.88	97
H5602	58	-0.04	0.48	48	65	0.3434	0.63	67	82	1.96	0.97	100
C4808	65	0.904	0.82	90	60	1.3178	0.91	100	70	1.1	0.86	95
S6073	70	1.576	0.94	100	60	1.3178	0.91	100	101	3.33	1.00	100
H5390	68	1.307	0.90	100	57	1.9024	0.97	100	75	1.46	0.93	100
W7652	55	-0.44	0.33	29	66	0.1486	0.56	57	70	1.1	0.86	95
G5717	59	0.096	0.54	55	65	0.3434	0.63	67	65	0.74	0.77	84
T3935	55	-0.44	0.33	29	57	1.9024	0.97	100	78	1.67	0.95	100
M4991	70	1.576	0.94	100	60	1.3178	0.91	100	77	1.6	0.95	100
P7178	69	1.442	0.93	100	69	-0.436	0.33	29	44	-0.77	0.22	15
G2975	56	-0.31	0.38	35	75	-1.605	0.05	0	33	-1.57	0.06	0
R1870	72	1.846	0.97	100	61	1.1229	0.87	96	89	2.46	0.99	100
S4390	68	1.307	0.90	100	75	-1.605	0.05	0	48	-0.49	0.31	27
W0506	56	-0.31	0.38	35	69	-0.436	0.33	29	52	-0.2	0.42	40
S2374	54	-0.58	0.28	23	64	0.5383	0.70	76	53	-0.13	0.45	44
W4245	61	0.365	0.64	68	64	0.5383	0.70	76	54	-0.05	0.48	47
H8781	69	1.442	0.93	100	70	-0.631	0.26	21	65	0.74	0.77	84
C3523	57	-0.17	0.43	41	73	-1.215	0.11	2	40	-1.06	0.14	6
W1482	50	-1.11	0.13	4	73	-1.215	0.11	2	45	-0.7	0.24	18
C4922	61	0.365	0.64	68	65	0.3434	0.63	67	48	-0.49	0.31	27
D7893	65	0.904	0.82	90	68	-0.241	0.40	38	60	0.38	0.65	68
J4197	59	0.096	0.54	55	62	0.928	0.82	90	54	-0.05	0.48	47
B5875	55	-0.44	0.33	29	70	-0.631	0.26	21	47	-0.56	0.29	24
C7367	47	-1.52	0.06	0	71	-0.826	0.20	13	34	-1.49	0.07	0
W3437	63	0.635	0.74	80	66	0.1486	0.56	57	60	0.38	0.65	68
C9543	63	0.635	0.74	80	68	-0.241	0.40	38	76	1.53	0.94	100
M9969	51	-0.98	0.16	8	66	0.1486	0.56	57	55	0.02	0.51	51
M6370	63	0.635	0.74	80	61	1.1229	0.87	96	50	-0.34	0.37	33
T1022	47	-1.52	0.06	0	69	-0.436	0.33	29	60	0.38	0.65	68
D9035	73	1.98	0.98	100	61	1.1229	0.87	96	75	1.46	0.93	100
F7251	50	-1.11	0.13	4	72	-1.021	0.15	7	50	-0.34	0.37	33
O8961	50	-1.11	0.13	4	70	-0.631	0.26	21	36	-1.35	0.09	0
O4718	44	-1.92	0.03	0	69	-0.436	0.33	29	50	-0.34	0.37	33
H7774	49	-1.25	0.11	1	64	0.5383	0.70	76	47	-0.56	0.29	24
M3614	49	-1.25	0.11	1	73	-1.215	0.11	2	25	-2.14	0.02	0
G7847	53	-0.71	0.24	17	77	-1.995	0.02	0	48	-0.49	0.31	27
M5998	62	0.5	0.69	74	69	-0.436	0.33	29	42	-0.92	0.18	10
L5802	64	0.769	0.78	85	64	0.5383	0.70	76	64	0.66	0.75	81
D2647	59	0.096	0.54	55	62	0.928	0.82	90	50	-0.34	0.37	33
M5081	72	1.846	0.97	100	67	-0.046	0.48	48	48	-0.49	0.31	27
B5242	55	-0.44	0.33	29	70	-0.631	0.26	21	35	-1.42	0.08	0
S7071	58	-0.04	0.48	48								
B7363	52	-0.85	0.20	12	68	-0.241	0.40	38	58	0.23	0.59	62
M6250	48	-1.38	0.08	0	62	0.928	0.82	90	47	-0.56	0.29	24

Marking	Squats	Z	%	Points	Shuttle Run	Z	%	Points	Army Pushups	Z	%	Points
S8170	62	0.5	0.69	74	68	-0.241	0.40	38	55	0.02	0.51	51
W7224	54	-0.58	0.28	23	71	-0.826	0.20	13	41	-0.99	0.16	8
F1550	59	0.096	0.54	55	62	0.928	0.82	90	58	0.23	0.59	62
T1569	49	-1.25	0.11	1	72	-1.021	0.15	7	47	-0.56	0.29	24
C4822	58	-0.04	0.48	48	68	-0.241	0.40	38	45	-0.7	0.24	18
R6465	54	-0.58	0.28	23	71	-0.826	0.20	13	35	-1.42	0.08	0
F6822	38	-2.73	0.00	0	65	0.3434	0.63	67	38	-1.21	0.11	2
S0701	61	0.365	0.64	68	67	-0.046	0.48	48	40	-1.06	0.14	6
O5519	57	-0.17	0.43	41	76	-1.8	0.04	0	32	-1.64	0.05	0
S4148	52	-0.85	0.20	12	69	-0.436	0.33	29	45	-0.7	0.24	18
C2754	58	-0.04	0.48	48	67	-0.046	0.48	48	49	-0.41	0.34	30
D7810	56	-0.31	0.38	35	73	-1.215	0.11	2	40	-1.06	0.14	6
K4493	48	-1.38	0.08	0	66	0.1486	0.56	57	58	0.23	0.59	62
G2698												
P4825	53	-0.71	0.24	17	67	-0.046	0.48	48	47	-0.56	0.29	24
L4008	62	0.5	0.69	74	62	0.928	0.82	90	59	0.3	0.62	65
P7599	66	1.038	0.85	94	65	0.3434	0.63	67	44	-0.77	0.22	15
W0142	54	-0.58	0.28	23	66	0.1486	0.56	57	40	-1.06	0.14	6
H0975	57	-0.17	0.43	41	66	0.1486	0.56	57	60	0.38	0.65	68
G5491	51	-0.98	0.16	8	62	0.928	0.82	90	62	0.52	0.70	75
T8117												
T7266	62	0.5	0.69	74	79	-2.385	0.01	0	58	0.23	0.59	62
L7674												
G2835	56	-0.31	0.38	35	62	0.928	0.82	90	56	0.09	0.54	54
E8412	64	0.769	0.78	85	55	2.2921	0.99	100	73	1.31	0.91	100
G7630	56	-0.31	0.38	35	60	1.3178	0.91	100	60	0.38	0.65	68
L5409	55	-0.44	0.33	29	63	0.7332	0.77	84	53	-0.13	0.45	44
N5969	59	0.096	0.54	55	66	0.1486	0.56	57	47	-0.56	0.29	24
P4801	60	0.231	0.59	61	65	0.3434	0.63	67	70	1.1	0.86	95
S8868	65	0.904	0.82	90	61	1.1229	0.87	96	50	-0.34	0.37	33
J2723	47	-1.52	0.06	0	67	-0.046	0.48	48	55	0.02	0.51	51
C7189	63	0.635	0.74	80	64	0.5383	0.70	76	69	1.02	0.85	93
B5401	62	0.5	0.69	74	63	0.7332	0.77	84	61	0.45	0.67	72
F3358	56	-0.31	0.38	35	69	-0.436	0.33	29	47	-0.56	0.29	24
I9991	71	1.711	0.96	100	66	0.1486	0.56	57	73	1.31	0.91	100
L9118												
L4216	62	0.5	0.69	74	66	0.1486	0.56	57	56	0.09	0.54	54
S7278	73	1.98	0.98	100	61	1.1229	0.87	96	70	1.1	0.86	95
O5892	53	-0.71	0.24	17	70	-0.631	0.26	21	56	0.09	0.54	54
R0404												
H6001	66	1.038	0.85	94	76	-1.8	0.04	0	50	-0.34	0.37	33
L4872	67	1.173	0.88	97	82	-2.969	0.00	0	51	-0.27	0.39	37

Marking	1-Mile Run	Z	%	Points	Heel Hooks	Z	%	Points	Army Composite	Z	%
B6291	393	0.988	0.84	92	25	0.939	0.83	91	345	0.2843	0.61
H5602	328	1.891	0.97	100	28	1.47	0.93	100	416	0.7824	0.78
C4808	412	0.724	0.77	83	23	0.585	0.72	78	487	1.2805	0.90
S6073	365	1.377	0.92	100	23	0.585	0.72	78	570	1.8628	0.97
H5390	392	1.002	0.84	93	29	1.647	0.95	100	591	2.0102	0.98
W7652	456	0.113	0.55	56	13	-1.19	0.12	2	339	0.2422	0.60
G5717	440	0.336	0.63	66	16	-0.65	0.26	20	322	0.1229	0.55
T3935	350	1.586	0.94	100	22	0.408	0.66	70	499	1.3647	0.91
M4991	392	1.002	0.84	93	22	0.408	0.66	70	563	1.8137	0.97
P7178	515	-0.71	0.24	17	17	-0.48	0.32	27	239	-0.459	0.32
G2975	598	-1.86	0.03	0	14	-1.01	0.16	7	134	-1.196	0.12
R1870	342	1.697	0.96	100	30	1.824	0.97	100	526	1.5541	0.94

Marking	1 Mile Run	Z	%	Points	Heel Hooks	Z	%	Points	Army Composite	Z	%
S4390	525	-0.85	0.20	12	10	-1.72	0.04	0	140	-1.154	0.12
W0506	526	-0.86	0.20	12	19	-0.12	0.45	44	201	-0.726	0.23
S2374	419	0.627	0.73	79	22	0.408	0.66	70	384	0.5579	0.71
W4245	443	0.294	0.62	64	24	0.762	0.78	85	432	0.8946	0.81
H8781	450	0.197	0.58	60	20	0.054	0.52	53	335	0.2141	0.58
C3523	633	-2.35	0.01	0	12	-1.36	0.09	0	75	-1.61	0.05
W1482	526	-0.86	0.20	12	11	-1.54	0.06	0	57	-1.736	0.04
C4922	460	0.058	0.52	53	18	-0.3	0.38	35	311	0.0457	0.52
D7893	604	-1.94	0.03	0	21	0.231	0.59	61	352	0.3334	0.63
J4197	445	0.266	0.60	63	4	-2.78	0.00	0	311	0.0457	0.52
B5875	476	-0.16	0.43	42	20	0.054	0.52	53	215	-0.628	0.27
C7367											
W3437	470	-0.08	0.47	46	16	-0.65	0.26	20	306	0.0107	0.50
C9543	449	0.21	0.58	60	25	0.939	0.83	91	386	0.5719	0.72
M9969	552	-1.22	0.11	1	20	0.054	0.52	53	258	-0.326	0.37
M6370	461	0.044	0.52	52	22	0.408	0.66	70	382	0.5439	0.71
T1022	500	-0.5	0.31	26	18	-0.3	0.38	35	253	-0.361	0.36
D9035	355	1.516	0.94	100	30	1.824	0.97	100	596	2.0452	0.98
F7251	468	-0.05	0.48	47	19	-0.12	0.45	44	191	-0.796	0.21
O8961	495	-0.43	0.33	29	17	-0.48	0.32	27	94	-1.477	0.07
O4718	463	0.016	0.51	51	13	-1.19	0.12	2	118	-1.308	0.10
H7774	365	1.377	0.92	100	14	-1.01	0.16	7	259	-0.319	0.37
M3614	419	0.627	0.73	79	17	-0.48	0.32	27	135	-1.189	0.12
G7847	475	-0.15	0.44	43	16	-0.65	0.26	20	107	-1.385	0.08
M5998	517	-0.73	0.23	16	18	-0.3	0.38	35	190	-0.803	0.21
L5802	450	0.197	0.58	60	25	0.939	0.83	91	459	1.0841	0.86
D2647	498	-0.47	0.32	27	30	1.824	0.97	100	393	0.621	0.73
M5081	489	-0.35	0.36	33	23	0.585	0.72	78	299	-0.038	0.48
B5242	533	-0.96	0.17	9	16	-0.65	0.26	20	79	-1.582	0.06
S7071											
B7363	386	1.086	0.86	95	23	0.585	0.72	78	291	-0.095	0.46
M6250	389	1.044	0.85	94	29	1.647	0.95	100	384	0.5579	0.71
S8170	398	0.919	0.82	90	20	0.054	0.52	53	362	0.4035	0.66
W7224	469	-0.07	0.47	47	16	-0.65	0.26	20	111	-1.357	0.09
F1550	405	0.822	0.79	87	26	1.116	0.87	96	461	1.0981	0.86
T1569	533	-0.96	0.17	9	20	0.054	0.52	53	150	-1.084	0.14
C4822	607	-1.98	0.02	0	21	0.231	0.59	61	206	-0.691	0.24
R6465	581	-1.62	0.05	0	14	-1.01	0.16	7	84	-1.547	0.06
F6822	697	-3.23	0.00	0	17	-0.48	0.32	27	188	-0.817	0.21
S0701	522	-0.8	0.21	14	17	-0.48	0.32	27	173	-0.922	0.18
O5519	579	-1.6	0.06	0	13	-1.19	0.12	2	43	-1.834	0.03
S4148	448	0.224	0.59	61	18	-0.3	0.38	35	216	-0.621	0.27
C2754	495	-0.43	0.33	29	21	0.231	0.59	61	287	-0.123	0.45
D7810	542	-1.08	0.14	5	24	0.762	0.78	85	139	-1.161	0.12
K4493	413	0.711	0.76	83	20	0.054	0.52	53	290	-0.102	0.46
G2698											
P4825	455	0.127	0.55	56	18	-0.3	0.38	35	226	-0.551	0.29
L4008	511	-0.65	0.26	20	22	0.408	0.66	70	419	0.8034	0.79
P7599	468	-0.05	0.48	47	17	-0.48	0.32	27	285	-0.137	0.45
W0142	427	0.516	0.70	75	19	-0.12	0.45	44	256	-0.34	0.37
H0975	436	0.391	0.65	69	24	0.762	0.78	85	320	0.1089	0.54
G5491	410	0.752	0.77	84	16	-0.65	0.26	20	377	0.5088	0.69
T8117											
T7266	517	-0.73	0.23	16	19	-0.12	0.45	44	222	-0.579	0.28
L7674											
G2835	461	0.044	0.52	52	18	-0.3	0.38	35	327	0.158	0.56

Marking	1-Mile Run	Z	%	Points	Heel Hooks	Z	%	Points	Army Composite	Z	%
E8412	359	1.461	0.93	100	31	2.001	0.98	100	585	1.9681	0.98
G7630	366	1.364	0.91	100	24	0.762	0.78	85	449	1.0139	0.84
L5409	359	1.461	0.93	100	19	-0.12	0.45	44	367	0.4386	0.67
N5969	502	-0.53	0.30	25	9	-1.89	0.03	0	232	-0.509	0.31
P4801	428	0.502	0.69	74	21	0.231	0.59	61	424	0.8385	0.80
S8868	424	0.558	0.71	76	26	1.116	0.87	96	442	0.9648	0.83
J2723	510	-0.64	0.26	20	20	0.054	0.52	53	233	-0.501	0.31
C7189	425	0.544	0.71	76	28	1.47	0.93	100	505	1.4068	0.92
B5401	447	0.238	0.59	62	22	0.408	0.66	70	446	0.9929	0.84
F3358	479	-0.21	0.42	40	19	-0.12	0.45	44	252	-0.368	0.36
I9991	385	1.1	0.86	96	20	0.054	0.52	53	457	1.07	0.86
L9118											
L4216	473	-0.12	0.45	44	16	-0.65	0.26	20	305	0.0036	0.50
S7278	414	0.697	0.76	82	26	1.116	0.87	96	557	1.7716	0.96
O5892	505	-0.57	0.29	23	21	0.231	0.59	61	247	-0.403	0.34
R0404											
H6001	497	-0.46	0.32	28	20	0.054	0.52	53	225	-0.558	0.29
L4872	497	-0.46	0.32	28	0	-3.49	0.00	0	162	-1	0.16

Marking	1/2-Mile Run	Z	%	Points	30-lb. Lifts	Z	%	Points	MANUF	Z	%	Points	Grenade?
B6291	176	0.2	0.58	60	56	-0.92	0.18	10	373	-0.072	0.47	46	yes
H5602	147	1.72	0.96	100	100	1.056	0.85	94	168	0.7536	0.77	84	yes
C4808	153	1.41	0.92	100	92	0.697	0.76	82	233	0.4919	0.69	74	no
S6073	153	1.41	0.92	100	100	1.056	0.85	94	179	0.7093	0.76	83	no
H5390	152	1.46	0.93	100	119	1.909	0.97	100	151	0.8221	0.79	87	yes
W7652	182	-0.11	0.45	44	57	-0.87	0.19	11	237	0.4758	0.68	73	yes
G5717	176	0.2	0.58	60	87	0.473	0.68	73	169	0.7496	0.77	84	yes
T3935	140	2.09	0.98	100	70	-0.29	0.39	36	198	0.6328	0.74	80	yes
M4991	155	1.3	0.90	100	93	0.742	0.77	84	158	0.7939	0.79	86	yes
P7178	185	-0.27	0.39	37	63	-0.6	0.27	22	900	-2.194	0.01	0	n/a
G2975	194	-0.74	0.23	16	70	-0.29	0.39	36	198	0.6328	0.74	80	yes
R1870	152	1.46	0.93	100	95	0.832	0.80	87	384	-0.116	0.45	44	no
S4390	204	-1.27	0.10	0	35	-1.86	0.03	0	900	-2.194	0.01	0	n/a
W0506	183	-0.17	0.43	42	62	-0.65	0.26	20	224	0.5281	0.70	75	yes
S2374	173	0.36	0.64	68	60	-0.74	0.23	16	229	0.508	0.69	74	no
W4245	166	0.73	0.77	83	105	1.281	0.90	100	185	0.6852	0.75	82	yes
H8781	180	-0.01	0.50	50	95	0.832	0.80	87	900	-2.194	0.01	0	n/a
C3523	231	-2.69	0.00	0	80	0.159	0.56	58	291	0.2583	0.60	63	yes
W1482	208	-1.48	0.07	0	117	1.82	0.97	100	405	-0.201	0.42	40	yes
C4922	169	0.57	0.72	77	78	0.069	0.53	53	360	-0.02	0.49	49	yes
D7893	197	-0.9	0.18	10	55	-0.96	0.17	8	900	-2.194	0.01	0	n/a
J4197	157	1.2	0.88	98	50	-1.19	0.12	2	900	-2.194	0.01	0	n/a
B5875	188	-0.43	0.33	29	94	0.787	0.78	86	226	0.5201	0.70	75	no
C7367													
W3437	181	-0.06	0.48	47	91	0.652	0.74	80	200	0.6248	0.73	79	yes
C9543	181	-0.06	0.48	47	65	-0.51	0.30	25	900	-2.194	0.01	0	n/a
M9969	193	-0.69	0.24	18	76	-0.02	0.49	49	219	0.5483	0.71	76	no
M6370	158	1.15	0.87	97	70	-0.29	0.39	36	221	0.5402	0.71	76	yes
T1022	189	-0.48	0.32	27	75	-0.07	0.47	47	205	0.6046	0.73	78	yes
D9035	154	1.36	0.91	100	100	1.056	0.85	94	197	0.6368	0.74	80	yes
F7251	189	-0.48	0.32	27	65	-0.51	0.30	25	248	0.4315	0.67	71	no
O8961	183	-0.17	0.43	42	68	-0.38	0.35	31	271	0.3389	0.63	67	no
O4718	187	-0.38	0.35	32	65	-0.51	0.30	25	895	-2.174	0.01	0	no
H7774	155	1.3	0.90	100	59	-0.78	0.22	15	207	0.5966	0.72	78	no
M3614													
G7847	182	-0.11	0.45	44	35	-1.86	0.03	0	900	-2.194	0.01	0	n/a

Marking	1/2-Mile Run	Z	%	Points	30-lb. Lifts	Z	%	Points	MANUF	Z	%	Points	Grenade?
M5998													
L5802	180	-0.01	0.50	50	75	-0.07	0.47	47	336	0.0771	0.53	54	yes
D2647	176	0.2	0.58	60	96	0.877	0.81	89					
M5081	189	-0.48	0.32	27	78	0.069	0.53	53	362	-0.028	0.49	49	no
B5242	208	-1.48	0.07	0	45	-1.41	0.08	0	900	-2.194	0.01	0	n/a
S7071													
B7363	180	-0.01	0.50	50	80	0.159	0.56	58	515	-0.644	0.26	20	no
M6250	160	1.04	0.85	94	64	-0.56	0.29	23	220	0.5442	0.71	76	no
S8170	180	-0.01	0.50	50	88	0.518	0.70	75	195	0.6449	0.74	80	no
W7224	194	-0.74	0.23	16	40	-1.64	0.05	0	385	-0.12	0.45	44	no
F1550	165	0.78	0.78	85	103	1.191	0.88	98	354	0.0046	0.50	50	yes
T1569	205	-1.32	0.09	0	62	-0.65	0.26	20	202	0.6167	0.73	79	no
C4822	182	-0.11	0.45	44	54	-1.01	0.16	7	181	0.7013	0.76	82	no
R6465	213	-1.74	0.04	0	75	-0.07	0.47	47	207	0.5966	0.72	78	no
F6822	195	-0.8	0.21	14	91	0.652	0.74	80	193	0.653	0.74	80	no
S0701	190	-0.53	0.30	25	66	-0.47	0.32	27	224	0.5281	0.70	75	yes
O5519	220	-2.11	0.02	0	51	-1.14	0.13	3	900	-2.194	0.01	0	n/a
S4148	183	-0.17	0.43	42	95	0.832	0.80	87	153	0.814	0.79	87	no
C2754	187	-0.38	0.35	32	64	-0.56	0.29	23	298	0.2301	0.59	61	no
D7810	199	-1.01	0.16	7	72	-0.2	0.42	40	364	-0.036	0.49	48	yes
K4493													
G2698	187	-0.38	0.35	32	116	1.775	0.96	100	190	0.665	0.75	81	no
P4825	182	-0.11	0.45	44	70	-0.29	0.39	36	226	0.5201	0.70	75	no
L4008	185	-0.27	0.39	37	113	1.64	0.95	100	168	0.7536	0.77	84	no
P7599	168	0.62	0.73	79	74	-0.11	0.46	44	206	0.6006	0.73	78	yes
W0142	174	0.31	0.62	65	65	-0.51	0.30	25	185	0.6852	0.75	82	no
H0975	181	-0.06	0.48	47	117	1.82	0.97	100	520	-0.664	0.25	19	yes
G5491	162	0.94	0.83	91	67	-0.43	0.34	29	183	0.6932	0.76	82	no
T8117	175	0.25	0.60	63	62	-0.65	0.26	20	363	-0.032	0.49	48	yes
T7266	192	-0.64	0.26	20	101	1.101	0.86	96	197	0.6368	0.74	80	no
L7674	184	-0.22	0.41	39	50	-1.19	0.12	2	900	-2.194	0.01	0	n/a
G2835	148	1.67	0.95	100									
E8412	143	1.93	0.97	100	127	2.269	0.99	100	144	0.8503	0.80	88	yes
G7630	164	0.83	0.80	87	73	-0.16	0.44	42	191	0.661	0.75	81	yes
L5409	165	0.78	0.78	85	62	-0.65	0.26	20	170	0.7456	0.77	84	no
N5969	187	-0.38	0.35	32	65	-0.51	0.30	25	276	0.3187	0.63	66	yes
P4801	179	0.04	0.52	52	72	-0.2	0.42	40	181	0.7013	0.76	82	yes
S8868	170	0.52	0.70	75	97	0.922	0.82	90	206	0.6006	0.73	78	yes
J2723	183	-0.17	0.43	42	73	-0.16	0.44	42	213	0.5724	0.72	77	yes
C7189	165	0.78	0.78	85	102	1.146	0.87	97	304	0.206	0.58	60	no
B5401	175	0.25	0.60	63	78	0.069	0.53	53	450	-0.382	0.35	31	yes
F3358	187	-0.38	0.35	32	67	-0.43	0.34	29	280	0.3026	0.62	65	no
I9991	165	0.78	0.78	85	62	-0.65	0.26	20	369	-0.056	0.48	47	yes
L9118													
L4216	191	-0.59	0.28	22	90	0.608	0.73	79	248	0.4315	0.67	71	yes
S7278	164	0.83	0.80	87	124	2.134	0.98	100	191	0.661	0.75	81	yes
O5892	200	-1.06	0.14	6	70	-0.29	0.39	36	299	0.2261	0.59	61	yes
R0404	186	-0.32	0.37	34	77	0.024	0.51	51	430	-0.301	0.38	35	yes
H6001	218	-2	0.02	0	57	-0.87	0.19	11	392	-0.148	0.44	43	no
L4872	228	-2.53	0.01	0	9	-3.03	0.00	0	900	-2.194	0.01	0	n/a

Marking	Marine Composite	Z	%	Combat Composite	Z	%	Portal	AFPFT date
B6291	116	-0.5508	0.29	577	-0.1678	0.43	yes	4-Oct-08
H5602	278	1.66999	0.95	972	1.2854	0.90	yes	27-Aug-08
C4808	256	1.3684	0.91	999	1.3847	0.92	yes	2-Jul-08
S6073	277	1.65628	0.95	1124	1.8446	0.97	yes	10-Sep-08

Marking	Marine Composite	Z	%	Combat Composite	Z	%	Portal	AFPFT date
H5390	287	1.79337	0.96	1165	1.9954	0.98	yes	26-Sep-08
W7652	128	-0.3863	0.35	595	-0.1016	0.46	yes	10-Sep-08
G5717	217	0.83376	0.80	756	0.4907	0.69	yes	17-Jul-08
T3935	216	0.82006	0.79	931	1.1346	0.87	yes	17-Jul-08
M4991	270	1.56032	0.94	1103	1.7673	0.96	yes	20-May-08
P7178	59	-1.3322	0.09	357	-0.9772	0.16	yes	7-Oct-08
G2975	132	-0.3315	0.37	398	-0.8263	0.20	yes	7-Oct-08
R1870	231	1.02569	0.85	988	1.3443	0.91	yes	7-Oct-08
S4390	0	-2.141	0.02	140	-1.7755	0.04	yes	21-Oct-08
W0506	137	-0.2629	0.40	475	-0.543	0.29	yes	7-Oct-08
S2374	158	0.02496	0.51	700	0.2847	0.61	yes	21-Oct-08
W4245	265	1.49178	0.93	962	1.2486	0.89	yes	23-Oct-08
H8781	137	-0.2629	0.40	609	-0.0501	0.48	yes	21-Oct-08
C3523	121	-0.4823	0.31	317	-1.1243	0.13	yes	28-Oct-08
W1482	140	-0.2218	0.41	337	-1.0507	0.15	yes	23-Oct-08
C4922	179	0.31284	0.62	669	0.1707	0.57	yes	23-Oct-08
D7893	18	-1.8942	0.03	388	-0.8631	0.19	yes	23-Oct-08
J4197	100	-0.7701	0.22	511	-0.4106	0.34	yes	16-Oct-08
B5875	190	0.46363	0.68	595	-0.1016	0.46	yes	23-Oct-08
C7367								
W3437	206	0.68297	0.75	718	0.3509	0.64	yes	23-Oct-08
C9543	72	-1.154	0.12	530	-0.3407	0.37	yes	23-Oct-08
M9969	143	-0.1807	0.43	544	-0.2892	0.39	yes	27-Oct-08
M6370	209	0.7241	0.77	800	0.6526	0.74	yes	27-Oct-08
T1022	152	-0.0573	0.48	557	-0.2414	0.40	yes	23-Oct-08
D9035	274	1.61516	0.95	1144	1.9182	0.97	yes	23-Oct-08
F7251	123	-0.4548	0.32	437	-0.6828	0.25	yes	27-Oct-08
O8961	140	-0.2218	0.41	374	-0.9146	0.18	yes	27-Oct-08
O4718	57	-1.3596	0.09	232	-1.437	0.08	yes	23-Oct-08
H7774	193	0.50476	0.69	645	0.0824	0.53	yes	27-Oct-08
M3614							yes	23-Oct-08
G7847	44	-1.5378	0.06	195	-1.5731	0.06	yes	30-May-08
M5998							yes	27-Oct-08
L5802	151	-0.071	0.47	761	0.5091	0.69	yes	23-Oct-08
D2647							yes	27-Oct-08
M5081	129	-0.3726	0.35	557	-0.2414	0.40	yes	23-Oct-08
B5242	0	-2.141	0.02	79	-1.9999	0.02	yes	23-Oct-08
S7071							yes	23-Oct-08
B7363	128	-0.3863	0.35	547	-0.2782	0.39	yes	2-Oct-08
M6250	193	0.50476	0.69	770	0.5422	0.71	yes	4-Apr-08
S8170	205	0.66926	0.75	772	0.5496	0.71	yes	10-Jun-08
W7224	60	-1.3185	0.09	231	-1.4407	0.07	yes	2-Oct-08
F1550	233	1.0531	0.85	927	1.1198	0.87	yes	21-Feb-08
T1569	99	-0.7839	0.22	348	-1.0103	0.16	yes	24-Mar-08
C4822	133	-0.3178	0.38	472	-0.5541	0.29	yes	11-Mar-08
R6465	125	-0.4274	0.33	334	-1.0618	0.14	yes	7-Jan-08
F6822	174	0.24429	0.60	536	-0.3186	0.38	yes	10-Jan-08
S0701	127	-0.4	0.34	427	-0.7196	0.24	yes	24-Mar-08
O5519	3	-2.0999	0.02	49	-2.1103	0.02	yes	24-Mar-08
S4148	216	0.82006	0.79	648	0.0934	0.54	yes	22-Oct-08
C2754	116	-0.5508	0.29	519	-0.3812	0.35	yes	24-Oct-08
D7810	95	-0.8387	0.20	329	-1.0802	0.14	yes	24-Oct-08
K4493								
G2698	213	0.77893	0.78					
P4825	155	-0.0162	0.49	536	-0.3186	0.38	yes	22-Oct-08
L4008	221	0.8886	0.81	861	0.877	0.81	yes	24-Oct-08

Marking	Marine Composite	Z	%	Combat Composite	Z	%	Portal	AFPFT date
P7599	201	0.61443	0.73	687	0.2369	0.59	yes	24-Oct-08
W0142	172	0.21688	0.59	600	-0.0832	0.47	yes	24-Oct-08
H0975	166	0.13463	0.55	652	0.1081	0.54	yes	21-Apr-08
G5491	202	0.62814	0.74	781	0.5827	0.72	yes	24-Oct-08
T8117	131	-0.3452	0.36				yes	15-Oct-08
T7266	196	0.54588	0.71	614	-0.0317	0.49	yes	15-Oct-08
L7674	41	-1.579	0.06				yes	15-Oct-08
G2835							yes	15-Oct-08
E8412	288	1.80708	0.96	1161	1.9807	0.98	yes	3-Oct-08
G7630	210	0.7378	0.77	869	0.9065	0.82	yes	15-Oct-08
L5409	189	0.44992	0.67	745	0.4503	0.67	yes	15-Oct-08
N5969	123	-0.4548	0.32	478	-0.532	0.30	yes	15-Oct-08
P4801	174	0.24429	0.60	772	0.5496	0.71	yes	15-Oct-08
S8868	243	1.19019	0.88	928	1.1235	0.87	yes	2-Jun-08
J2723	161	0.06608	0.53	555	-0.2487	0.40	yes	15-Oct-08
C7189	242	1.17648	0.88	989	1.3479	0.91	yes	23-Oct-08
B5401	147	-0.1258	0.45	740	0.4319	0.67	yes	5-May-08
F3358	126	-0.4137	0.34	504	-0.4364	0.33	yes	29-Apr-08
I9991	152	-0.0573	0.48	761	0.5091	0.69	yes	18-Jun-08
L9118								
L4216	172	0.21688	0.59	649	0.0971	0.54	yes	3-Nov-08
S7278	268	1.5329	0.94	1093	1.7305	0.96	yes	13-Dec-08
O5892	103	-0.729	0.23	453	-0.624	0.27	yes	31-Oct-08
R0404	120	-0.496	0.31				yes	27-Feb-08
H6001	54	-1.4007	0.08	333	-1.0654	0.14	yes	28-Mar-08
L4872	0	-2.141	0.02	162	-1.6945	0.05	yes	28-May-08

Marking	AF Composite	Z	%	1.5 Mile Run	Z	%	Points	~~Run Points~~	Z	%	Points
B6291	97.5	0.955	0.83	582	0.92	0.82	90	47.5	0.828	0.80	87
H5602	100	1.296	0.90	510	1.868	0.97	100	50	1.3738	0.92	100
C4808	92.25	0.238	0.59	619	0.433	0.67	71	43.5	-0.045	0.48	48
S6073	100	1.296	0.90	550	1.341	0.91	100	50	1.3738	0.92	100
H5390	100	1.296	0.90	557	1.249	0.89	99	50	1.3738	0.92	100
W7652	87.75	-0.376	0.35	714	-0.82	0.21	13	39	-1.028	0.15	7
G5717	83.7	-0.929	0.18	645	0.09	0.54	54	42	-0.373	0.35	32
T3935	100	1.296	0.90	530	1.604	0.95	100	50	1.3738	0.92	100
M4991	95	0.613	0.73	589	0.828	0.80	87	45	0.2822	0.61	64
P7178	92	0.204	0.58	663	-0.15	0.44	43	42	-0.373	0.35	32
G2975	82.7	-1.066	0.14	687	-0.46	0.32	28	40.5	-0.7	0.24	18
R1870	100	1.296	0.90	552	1.315	0.91	100	50	1.3738	0.92	100
S4390	100	1.296	0.90	664	-0.16	0.44	42	50	1.3738	0.92	100
W0506	90.5	-1E-03	0.50	697	-0.59	0.28	22	40.5	-0.7	0.24	18
S2374	95	0.613	0.73	619	0.433	0.67	71	45	0.2822	0.61	64
W4245	86	-0.615	0.27	617	0.459	0.68	72	43.5	-0.045	0.48	48
H8781	95	0.613	0.73	591	0.801	0.79	86	45	0.2822	0.61	64
C3523	75.6	-2.035	0.02	808	-2.06	0.02	0	36	-1.683	0.05	0
W1482	78.75	-1.605	0.05	752	-1.32	0.09	0	37.5	-1.355	0.09	0
C4922	85	-0.752	0.23	636	0.209	0.58	60	43.5	-0.045	0.48	48
D7893	86	-0.615	0.27	805	-2.02	0.02	0	36	-1.683	0.05	0
J4197	100	1.296	0.90	560	1.209	0.89	98	50	1.3738	0.92	100
B5875	82.4	-1.107	0.13	673	-0.28	0.39	36	40.5	-0.7	0.24	18
C7367											
W3437	80.3	-1.393	0.08	711	-0.78	0.22	15	39	-1.028	0.15	7
C9543	92	0.204	0.58	639	0.169	0.57	58	42	-0.373	0.35	32
M9969	86.75	-0.513	0.30	750	-1.29	0.10	0	37.5	-1.355	0.09	0
M6370	92	0.204	0.58	603	0.643	0.74	80	45	0.2822	0.61	64

Marking	AF Composite	Z	%	1.5 Mile Run	Z	%	Points	~~Run Points~~	Z	%	Points
T1022	80.3	-1.393	0.08	729	-1.02	0.15	7	39	-1.028	0.15	7
D9035	100	1.296	0.90	530	1.604	0.95	100	50	1.3738	0.92	100
F7251	93.5	0.409	0.66	638	0.182	0.57	59	43.5	-0.045	0.48	48
O8961	88	-0.342	0.37	653	-0.02	0.49	49	43.5	-0.045	0.48	48
O4718	89.25	-0.172	0.43	678	-0.34	0.37	33	40.5	-0.7	0.24	18
H7774	91	0.067	0.53	555	1.275	0.90	100	50	1.3738	0.92	100
M3614	82.8	-1.052	0.15	633	0.248	0.60	62	43.5	-0.045	0.48	48
G7847	100	1.296	0.90	627	0.327	0.63	66	50	1.3738	0.92	100
M5998	79.1	-1.557	0.06	743	-1.2	0.12	2	37.5	-1.355	0.09	0
L5802	92.25	0.238	0.59	653	-0.02	0.49	49	43.5	-0.045	0.48	48
D2647	92	0.204	0.58	653	-0.02	0.49	49	42	-0.373	0.35	32
M5081	92	0.204	0.58	647	0.064	0.53	53	42	-0.373	0.35	32
B5242	85	-0.752	0.23	728	-1	0.16	7	39	-1.028	0.15	7
S7071	86.5	-0.547	0.29	755	-1.36	0.09	0	37.5	-1.355	0.09	0
B7363	96.25	0.784	0.78	575	1.012	0.84	93	50	1.3738	0.92	100
M6250	100	1.296	0.90	567	1.117	0.87	96	50	1.3738	0.92	100
S8170	100	1.296	0.90	604	0.63	0.74	79	50	1.3738	0.92	100
W7224	93.5	0.409	0.66	733	-1.07	0.14	5	43.5	-0.045	0.48	48
F1550	100	1.296	0.90	575	1.012	0.84	93	50	1.3738	0.92	100
T1569	78.5	-1.639	0.05	758	-1.4	0.08	0	37.5	-1.355	0.09	0
C4822	79.5	-1.503	0.07	788	-1.79	0.04	0	36	-1.683	0.05	0
R6465	76.5	-1.912	0.03	811	-2.1	0.02	0	36	-1.683	0.05	0
F6822	79.1	-1.557	0.06	708	-0.74	0.23	16	39	-1.028	0.15	7
S0701	87	-0.479	0.32	672	-0.27	0.40	37	40.5	-0.7	0.24	18
O5519	90.5	-1E-03	0.50	799	-1.94	0.03	0	40.5	-0.7	0.24	18
S4148	84.3	-0.847	0.20	634	0.235	0.59	62	43.5	-0.045	0.48	48
C2754	87	-0.479	0.32	667	-0.2	0.42	40	40.5	-0.7	0.24	18
D7810	81	-1.298	0.10	741	-1.17	0.12	3	39	-1.028	0.15	7
K4493											
G2698											
P4825	91	0.067	0.53	639	0.169	0.57	58	42	-0.373	0.35	32
L4008	92	0.204	0.58	667	-0.2	0.42	40	42	-0.373	0.35	32
P7599	93.5	0.409	0.66	641	0.143	0.56	57	43.5	-0.045	0.48	48
W0142	83.35	-0.977	0.16	626	0.34	0.63	67	43.5	-0.045	0.48	48
H0975	95	0.613	0.73	603	0.643	0.74	80	47.5	0.828	0.80	87
G5491	100	1.296	0.90	556	1.262	0.90	100	50	1.3738	0.92	100
T8117	80.35	-1.387	0.08	718	-0.87	0.19	11	39	-1.028	0.15	7
T7266	80.3	-1.393	0.08	729	-1.02	0.15	7	39	-1.028	0.15	7
L7674	86	-0.615	0.27	739	-1.15	0.13	3	37.5	-1.355	0.09	0
G2835	87.35	-0.431	0.33	596	0.735	0.77	84	45	0.2822	0.61	64
E8412	100	1.296	0.90	503	1.96	0.97	100	50	1.3738	0.92	100
G7630	97.5	0.955	0.83	586	0.867	0.81	88	47.5	0.828	0.80	87
L5409	100	1.296	0.90	552	1.315	0.91	100	50	1.3738	0.92	100
N5969	87.75	-0.376	0.35	722	-0.92	0.18	10	39	-1.028	0.15	7
P4801	86	-0.615	0.27	626	0.34	0.63	67	43.5	-0.045	0.48	48
S8868	100	1.296	0.90	576	0.999	0.84	93	50	1.3738	0.92	100
J2723	82.7	-1.066	0.14	677	-0.33	0.37	34	40.5	-0.7	0.24	18
C7189	97.5	0.955	0.83	578	0.972	0.83	92	47.5	0.828	0.80	87
B5401	93.5	0.409	0.66	672	-0.27	0.40	37	43.5	-0.045	0.48	48
F3358	85.75	-0.649	0.26	726	-0.98	0.16	8	42	-0.373	0.35	32
I9991	99	1.159	0.88	552	1.315	0.91	100	50	1.3738	0.92	100
L9118											
L4216	93.5	0.409	0.66	650	0.024	0.51	51	43.5	-0.045	0.48	48
S7278	100	1.296	0.90	585	0.88	0.81	89	50	1.3738	0.92	100
O5892	92	0.204	0.58	714	-0.82	0.21	13	42	-0.373	0.35	32
R0404	95	0.613	0.73	604	0.63	0.74	79	47.5	0.828	0.80	87

Marking	AF Composite	Z	%	1.5 Mile Run	Z	%	Points	Run Points	Z	%	Points
H6001	81.5	-1.23	0.11	727	-0.99	0.16	8	40.5	-0.7	0.24	18
L4872	100	1.296	0.90	711	-0.78	0.22	15	50	1.3738	0.92	100

Marking	Abdominal Circ.	Z	%	Points	Ab.Circ. Points	Z	%	Points	Pushups	Z	%	Points
B6291	29.5	1.082	0.86	95	30	0.753	0.77	84	66	1.146	0.87	97
H5602	31	0.619	0.73	79	30	0.753	0.77	84	77	2.288	0.99	100
C4808	32.5	0.156	0.56	58	28.75	0.404	0.66	70	65	1.042	0.85	94
S6073	28	1.544	0.94	100	30	0.753	0.77	84	90	3.638	1.00	100
H5390	29.5	1.082	0.86	95	30	0.753	0.77	84	63	0.835	0.80	87
W7652	32.5	0.156	0.56	58	28.75	0.404	0.66	70	62	0.731	0.77	83
G5717	36	-0.92	0.18	10	22.2	-1.42	0.08	0	64	0.938	0.83	91
T3935	29.5	1.082	0.86	95	30	0.753	0.77	84	65	1.042	0.85	94
M4991	31.5	0.465	0.68	72	30	0.753	0.77	84	72	1.769	0.96	100
P7178	32	0.31	0.62	65	30	0.753	0.77	84	57	0.211	0.58	60
G2975	36	-0.92	0.18	10	22.2	-1.42	0.08	0	52	-0.31	0.38	35
R1870	30.5	0.773	0.78	85	30	0.753	0.77	84	80	2.6	1.00	100
S4390	29.5	1.082	0.86	95	30	0.753	0.77	84	42	-1.35	0.09	0
W0506	31.5	0.465	0.68	72	30	0.753	0.77	84	46	-0.93	0.18	9
S2374	33.5	-0.15	0.44	42	30	0.753	0.77	84	53	-0.2	0.42	40
W4245	35	-0.62	0.27	21	22.5	-1.34	0.09	0	57	0.211	0.58	60
H8781	30	0.927	0.82	90	30	0.753	0.77	84	62	0.731	0.77	83
C3523	38	-1.54	0.06	0	21.6	-1.59	0.06	0	50	-0.52	0.30	25
W1482	39.5	-2	0.02	0	21.25	-1.69	0.05	0	53	-0.2	0.42	40
C4922	37.5	-1.39	0.08	0	21.75	-1.55	0.06	0	56	0.108	0.54	55
D7893	27	1.853	0.97	100	30	0.753	0.77	84	57	0.211	0.58	60
J4197	29.5	1.082	0.86	95	30	0.753	0.77	84	58	0.315	0.62	65
B5875	37	-1.23	0.11	1	21.9	-1.51	0.07	0	57	0.211	0.58	60
C7367												
W3437	39	-1.85	0.03	0	21.3	-1.68	0.05	0	57	0.211	0.58	60
C9543	33	0.002	0.50	50	30	0.753	0.77	84	57	0.211	0.58	60
M9969	33	0.002	0.50	50	30	0.753	0.77	84	54	-0.1	0.46	45
M6370	33	0.002	0.50	50	27.5	0.055	0.52	53	57	0.211	0.58	60
T1022	39	-1.85	0.03	0	21.3	-1.68	0.05	0	57	0.211	0.58	60
D9035	32	0.31	0.62	65	30	0.753	0.77	84	60	0.523	0.70	75
F7251	35	-0.62	0.27	21	30	0.753	0.77	84	52	-0.31	0.38	35
O8961	34	-0.31	0.38	35	25	-0.64	0.26	20	49	-0.62	0.27	21
O4718	32.5	0.156	0.56	58	28.75	0.404	0.66	70	57	0.211	0.58	60
H7774	37.5	-1.39	0.08	0	21.75	-1.55	0.06	0	50	-0.52	0.30	25
M3614	39	-1.85	0.03	0	21.3	-1.68	0.05	0	37	-1.87	0.03	0
G7847	26	2.161	0.98	100	30	0.753	0.77	84	41	-1.45	0.07	0
M5998	38	-1.54	0.06	0	21.6	-1.59	0.06	0	57	0.211	0.58	60
L5802	32.5	0.156	0.56	58	28.75	0.404	0.66	70	53	-0.2	0.42	40
D2647	33	0.002	0.50	50	30	0.753	0.77	84	57	0.211	0.58	60
M5081	27.5	1.698	0.96	100	30	0.753	0.77	84	65	1.042	0.85	94
B5242	32	0.31	0.62	65	30	0.753	0.77	84	35	-2.07	0.02	0
S7071	31.5	0.465	0.68	72	30	0.753	0.77	84	46	-0.93	0.18	9
B7363	33.5	-0.15	0.44	42	26.25	-0.29	0.38	36	57	0.211	0.58	60
M6250	31.5	0.465	0.68	72	30	0.753	0.77	84	50	-0.52	0.30	25
S8170	32.5	0.156	0.56	58	30	0.753	0.77	84	50	-0.52	0.30	25
W7224	27	1.853	0.97	100	30	0.753	0.77	84	50	-0.52	0.30	25
F1550	32	0.31	0.62	65	30	0.753	0.77	84	52	-0.31	0.38	35
T1569	35	-0.62	0.27	21	22.5	-1.34	0.09	0	55	0.004	0.50	50
C4822	34	-0.31	0.38	35	25	-0.64	0.26	20	45	-1.03	0.15	6
R6465	34	-0.31	0.38	35	25	-0.64	0.26	20	36	-1.97	0.02	0
F6822	35.5	-0.77	0.22	15	22.35	-1.38	0.08	0	58	0.315	0.62	65
S0701	33	0.002	0.50	50	27.5	0.055	0.52	53	53	-0.2	0.42	40

Marking	Abdominal Circ.	Z	%	Points	Ab.Circ. Points	Z	%	Points	Pushups	Z	%	Points
O5519	30	0.927	0.82	90	30	0.753	0.77	84	42	-1.35	0.09	0
S4148	36.5	-1.08	0.14	5	22.05	-1.47	0.07	0	50	-0.52	0.30	25
C2754	32.5	0.156	0.56	58	28.75	0.404	0.66	70	49	-0.62	0.27	21
D7810	30.5	0.773	0.78	85	30	0.753	0.77	84	52	-0.31	0.38	35
K4493												
G2698												
P4825	30	0.927	0.82	90	30	0.753	0.77	84	52	-0.31	0.38	35
L4008	32.5	0.156	0.56	58	30	0.753	0.77	84	60	0.523	0.70	75
P7599	33	0.002	0.50	50	30	0.753	0.77	84	52	-0.31	0.38	35
W0142	38	-1.54	0.06	0	21.6	-1.59	0.06	0	48	-0.72	0.23	17
H0975	33	0.002	0.50	50	27.5	0.055	0.52	53	52	-0.31	0.38	35
G5491	31	0.619	0.73	79	30	0.753	0.77	84	60	0.523	0.70	75
T8117	38	-1.54	0.06	0	21.6	-1.59	0.06	0	56	0.108	0.54	55
T7266	39	-1.85	0.03	0	21.3	-1.68	0.05	0	57	0.211	0.58	60
L7674	28.5	1.39	0.92	100	30	0.753	0.77	84	57	0.211	0.58	60
G2835	35.5	-0.77	0.22	15	22.35	-1.38	0.08	0	57	0.211	0.58	60
E8412	32	0.31	0.62	65	30	0.753	0.77	84	73	1.873	0.97	100
G7630	33.5	-0.15	0.44	42	30	0.753	0.77	84	60	0.523	0.70	75
L5409	30.5	0.773	0.78	85	30	0.753	0.77	84	57	0.211	0.58	60
N5969	30	0.927	0.82	90	30	0.753	0.77	84	50	-0.52	0.30	25
P4801	35	-0.62	0.27	21	22.5	-1.34	0.09	0	62	0.731	0.77	83
S8868	31	0.619	0.73	79	30	0.753	0.77	84	57	0.211	0.58	60
J2723	36	-0.92	0.18	10	22.2	-1.42	0.08	0	57	0.211	0.58	60
C7189	30	0.927	0.82	90	30	0.753	0.77	84	65	1.042	0.85	94
B5401	32.5	0.156	0.56	58	30	0.753	0.77	84	53	-0.2	0.42	40
F3358	34.5	-0.46	0.32	28	23.75	-0.99	0.16	8	40	-1.55	0.06	0
I9991	32.5	0.156	0.56	58	30	0.753	0.77	84	47	-0.83	0.20	13
L9118												
L4216	33	0.002	0.50	50	30	0.753	0.77	84	50	-0.52	0.30	25
S7278	33	0.002	0.50	50	30	0.753	0.77	84	66	1.146	0.87	97
O5892	33	0.002	0.50	50	30	0.753	0.77	84	40	-1.55	0.06	0
R0404	33	0.002	0.50	50	27.5	0.055	0.52	53	52	-0.31	0.38	35
H6001	40	-2.16	0.02	0	21	-1.76	0.04	0	53	-0.2	0.42	40
L4872	27	1.853	0.97	100	30	0.753	0.77	84	30	-2.59	0.00	0

Marking	PU Points	Z	%	Points	Sit-Ups	Z	%	Points	Sit-Ups Points	Z	%	Points
B6291	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
H5602	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
C4808	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
S6073	10	0.45	0.67	72	70	2.23	0.99	100	10	0.262	0.60	63
H5390	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
W7652	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
G5717	10	0.45	0.67	72	53	-0.12	0.45	44	9.5	-0.25	0.40	38
T3935	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
M4991	10	0.45	0.67	72	61	0.986	0.84	92	10	0.262	0.60	63
P7178	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
G2975	10	0.45	0.67	72	52	-0.26	0.40	37	10	0.262	0.60	63
R1870	10	0.45	0.67	72	75	2.921	1.00	100	10	0.262	0.60	63
S4390	10	0.45	0.67	72	50	-0.53	0.30	25	10	0.262	0.60	63
W0506	10	0.45	0.67	72	50	-0.53	0.30	25	10	0.262	0.60	63
S2374	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
W4245	10	0.45	0.67	72	57	0.433	0.67	71	10	0.262	0.60	63
H8781	10	0.45	0.67	72	61	0.986	0.84	92	10	0.262	0.60	63
C3523	9.75	-0.01	0.50	50	43	-1.5	0.07	0	8.25	-1.529	0.06	0
W1482	10	0.45	0.67	72	52	-0.26	0.40	37	10	0.262	0.60	63
C4922	9.75	-0.01	0.50	50	55	0.157	0.56	58	10	0.262	0.60	63

Marking	~~PU Points~~	Z	%	Points	[redacted]	Z	%	Points	~~Sit-Ups Points~~	Z	%	Points
D7893	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
J4197	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
B5875	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
C7367												
W3437	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
C9543	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
M9969	9.25	-0.92	0.18	10	53	-0.12	0.45	44	10	0.262	0.60	63
M6370	10	0.45	0.67	72	52	-0.26	0.40	37	9.5	-0.25	0.40	38
T1022	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
D9035	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
F7251	10	0.45	0.67	72	51	-0.4	0.35	31	10	0.262	0.60	63
O8961	9.5	-0.46	0.32	28	51	-0.4	0.35	31	10	0.262	0.60	63
O4718	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
H7774	9.75	-0.01	0.50	50	49	-0.67	0.25	19	9.5	-0.25	0.40	38
M3614	8	-3.19	0.00	0	53	-0.12	0.45	44	10	0.262	0.60	63
G7847	10	0.45	0.67	72	47	-0.95	0.17	9	10	0.262	0.60	63
M5998	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
L5802	10	0.45	0.67	72	52	-0.26	0.40	37	10	0.262	0.60	63
D2647	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
M5081	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
B5242	7.75	-3.65	0.00	0	45	-1.23	0.11	1	8.25	-1.529	0.06	0
S7071	9	-1.37	0.09	0	51	-0.4	0.35	31	10	0.262	0.60	63
B7363	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
M6250	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
S8170	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
W7224	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
F1550	10	0.45	0.67	72	51	-0.4	0.35	31	10	0.262	0.60	63
T1569	9.5	-0.46	0.32	28	50	-0.53	0.30	25	9	-0.761	0.22	15
C4822	8.5	-2.28	0.01	0	55	0.157	0.56	58	10	0.262	0.60	63
R6465	7.75	-3.65	0.00	0	40	-1.92	0.03	0	7.75	-2.04	0.02	0
F6822	9	-1.37	0.09	0	50	-0.53	0.30	25	8.75	-1.017	0.15	7
S0701	9	-1.37	0.09	0	60	0.848	0.80	88	10	0.262	0.60	63
O5519	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
S4148	8.75	-1.83	0.03	0	55	0.157	0.56	58	10	0.262	0.60	63
C2754	8.75	-1.83	0.03	0	50	-0.53	0.30	25	9	-0.761	0.22	15
D7810	10	0.45	0.67	72	24	-4.13	0.00	0	2	-7.923	0.00	0
K4493												
G2698												
P4825	9	-1.37	0.09	0	63	1.263	0.90	100	10	0.262	0.60	63
L4008	10	0.45	0.67	72	60	0.848	0.80	88	10	0.262	0.60	63
P7599	10	0.45	0.67	72	52	-0.26	0.40	37	10	0.262	0.60	63
W0142	8.25	-2.74	0.00	0	55	0.157	0.56	58	10	0.262	0.60	63
H0975	10	0.45	0.67	72	52	-0.26	0.40	37	10	0.262	0.60	63
G5491	10	0.45	0.67	72	58	0.571	0.72	77	10	0.262	0.60	63
T8117	9.75	-0.01	0.50	50	53	-0.12	0.45	44	10	0.262	0.60	63
T7266	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
L7674	10	0.45	0.67	72	47	-0.95	0.17	9	8.5	-1.273	0.10	0
G2835	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
E8412	10	0.45	0.67	72	81	3.751	1.00	100	10	0.262	0.60	63
G7630	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
L5409	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
N5969	8.75	-1.83	0.03	0	53	-0.12	0.45	44	10	0.262	0.60	63
P4801	10	0.45	0.67	72	57	0.433	0.67	71	10	0.262	0.60	63
S8868	10	0.45	0.67	72	55	0.157	0.56	58	10	0.262	0.60	63
J2723	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
C7189	10	0.45	0.67	72	65	1.539	0.94	100	10	0.262	0.60	63

Marking	~~PU Points~~	Z	%	Points	Sit-Ups	Z	%	Points	~~Sit-Ups Points~~	Z	%	Points
B5401	10	0.45	0.67	72	53	-0.12	0.45	44	10	0.262	0.60	63
F3358	10	0.45	0.67	72	47	-0.95	0.17	9	10	0.262	0.60	63
I9991	10	0.45	0.67	72	46	-1.09	0.14	5	9	-0.761	0.22	15
L9118												
L4216	10	0.45	0.67	72	50	-0.53	0.30	25	10	0.262	0.60	63
S7278	10	0.45	0.67	72	66	1.677	0.95	100	10	0.262	0.60	63
O5892	10	0.45	0.67	72	47	-0.95	0.17	9	10	0.262	0.60	63
R0404	10	0.45	0.67	72	51	-0.4	0.35	31	10	0.262	0.60	63
H6001	10	0.45	0.67	72	48	-0.81	0.21	14	10	0.262	0.60	63
L4872	10	0.45	0.67	72	40	-1.92	0.03	0	10	0.262	0.60	63

Marking	Delta G to C	Run+PU+SU	Better?	Z	%	Delta AdjG to C
B6291	-0.397	96.4285714	0	0.772502	0.780	-0.347
H5602	-0.002	100	0	1.25369	0.895	0.006
C4808	0.323	90.7142857	0	0.002601	0.501	0.416
S6073	0.065	100	0	1.25369	0.895	0.072
H5390	0.075	100	0	1.25369	0.895	0.082
W7652	0.106	84.2857143	0	-0.86354	0.194	0.266
G5717	0.512	87.8571429	1	-0.38235	0.351	0.337
T3935	-0.031	100	0	1.25369	0.895	-0.023
M4991	0.231	92.8571429	0	0.291314	0.615	0.347
P7178	-0.416	88.5714286	0	-0.28611	0.387	-0.223
G2975	0.061	86.4285714	1	-0.57482	0.283	-0.078
R1870	0.008	100	0	1.25369	0.895	0.016
S4390	-0.865	100	0	1.25369	0.895	-0.857
W0506	-0.206	86.4285714	0	-0.57482	0.283	0.011
S2374	-0.118	92.8571429	0	0.291314	0.615	-0.003
W4245	0.625	90.7142857	1	0.002601	0.501	0.393
H8781	-0.250	92.8571429	0	0.291314	0.615	-0.135
C3523	0.110	77.1428571	1	-1.82591	0.034	0.097
W1482	0.092	82.1428571	1	-1.15225	0.125	0.022
C4922	0.342	90.3571429	1	-0.04552	0.482	0.086
D7893	-0.075	80	0	-1.44096	0.075	0.119
J4197	-0.562	100	0	1.25369	0.895	-0.554
B5875	0.325	86.4285714	1	-0.57482	0.283	0.177
C7367						
W3437	0.555	84.2857143	1	-0.86354	0.194	0.443
C9543	-0.214	88.5714286	0	-0.28611	0.387	-0.021
M9969	0.082	81.0714286	0	-1.29661	0.097	0.289
M6370	0.162	92.1428571	1	0.195076	0.577	0.166
T1022	0.323	84.2857143	1	-0.86354	0.194	0.211
D9035	0.070	100	0	1.25369	0.895	0.077
F7251	-0.411	90.7142857	0	0.002601	0.501	-0.254
O8961	-0.186	90	1	-0.09364	0.463	-0.283
O4718	-0.357	86.4285714	0	-0.57482	0.283	-0.207
H7774	0.006	98.9285714	1	1.109333	0.866	-0.334
M3614						
G7847	-0.845	100	0	1.25369	0.895	-0.837
M5998						
L5802	0.101	90.7142857	0	0.002601	0.501	0.194
D2647						
M5081	-0.176	88.5714286	0	-0.28611	0.387	0.017
B5242	-0.203	78.5714286	0	-1.63344	0.051	-0.028
S7071						
B7363	-0.393	100	1	1.25369	0.895	-0.505
M6250	-0.196	100	0	1.25369	0.895	-0.189

Marking	Delta G to C	Run+PU+SU	Better?	Z	%	Delta AdjG to C
S8170	-0.194	100	0	1.25369	0.895	-0.186
W7224	-0.584	90.7142857	0	0.002601	0.501	-0.426
F1550	-0.034	100	0	1.25369	0.895	-0.026
T1569	0.106	80	1	-1.44096	0.075	0.081
C4822	0.223	77.8571429	0	-1.72968	0.042	0.248
R6465	0.116	73.5714286	0	-2.3071	0.011	0.134
F6822	0.315	81.0714286	1	-1.29661	0.097	0.278
S0701	-0.080	85	0	-0.7673	0.221	0.014
O5519	-0.482	86.4285714	0	-0.57482	0.283	-0.265
S4148	0.339	88.9285714	1	-0.23799	0.406	0.131
C2754	0.035	83.2142857	0	-1.00789	0.157	0.195
D7810	0.043	72.8571429	0	-2.40334	0.008	0.132
K4493						
G2698						
P4825	-0.152	87.1428571	0	-0.47859	0.316	0.059
L4008	0.229	88.5714286	0	-0.28611	0.387	0.422
P7599	-0.065	90.7142857	0	0.002601	0.501	0.093
W0142	0.303	88.2142857	1	-0.33423	0.369	0.098
H0975	-0.187	96.4285714	1	0.772502	0.780	-0.237
G5491	-0.183	100	0	1.25369	0.895	-0.175
T8117						
T7266	0.406	84.2857143	1	-0.86354	0.194	0.293
L7674						
G2835						
E8412	0.074	100	0	1.25369	0.895	0.081
G7630	-0.012	96.4285714	0	0.772502	0.780	0.038
L5409	-0.229	100	0	1.25369	0.895	-0.221
N5969	-0.056	82.5	0	-1.10413	0.135	0.163
P4801	0.440	90.7142857	1	0.002601	0.501	0.208
S8868	-0.033	100	0	1.25369	0.895	-0.026
J2723	0.259	86.4285714	1	-0.57482	0.283	0.119
C7189	0.081	96.4285714	0	0.772502	0.780	0.131
B5401	0.009	90.7142857	0	0.002601	0.501	0.166
F3358	0.073	88.5714286	1	-0.28611	0.387	-0.056
I9991	-0.182	98.5714286	0	1.061214	0.856	-0.161
L9118						
L4216	-0.120	90.7142857	0	0.002601	0.501	0.038
S7278	0.056	100	0	1.25369	0.895	0.063
O5892	-0.314	88.5714286	0	-0.28611	0.387	-0.121
R0404						
H6001	0.034	86.4285714	1	-0.57482	0.283	-0.139
L4872	-0.857	100	0	1.25369	0.895	-0.850

KEY:

	Missing Data or Data Not Collected
	Voluntary Withdrawal or Injury
	Did Not Finish and/or Not Applicable
	Army PRT Event
	Marine CFT Event
	Air Force PFT Event (raw data)
	Air Force PFT Event (based on scoring charts)
	Composite Score (Army PRT, Marine CFT, or Air Force PFT)

Appendix P. CITI Certifications for Investigators

CITI Collaborative Institutional Training Initiative

Basic/Refresher Course - Human Subjects Research Curriculum Completion Report
Printed on Monday, June 9, 2008

Learner: Thomas Worden (username: worden23)
Institution: Air Force Research Laboratory
Contact Information Department: AFIT/ENV
Phone: 805-345-6543
Email: thomas.worden@afit.edu

Air Force Research Laboratory (AFRL):

Stage 1. Basic Biomedical course Passed on 06/09/08 (Ref # 1866765)

Required Modules	**Date Completed**	**Score**
Belmont Report and CITI Course Introduction	06/09/08	2/3 (67%)
History and Ethical Principles	06/09/08	5/5 (100%)
Defining Research with Human Subjects - SBR	06/09/08	4/5 (80%)
Basic Institutional Review Board (IRB) Regulations and Review Process	06/09/08	4/5 (80%)
Informed Consent	06/09/08	4/4 (100%)
Privacy and Confidentiality - SBR	06/09/08	3/5 (60%)
Social and Behavioral Research for Biomedical Researchers	06/09/08	2/4 (50%)
Records-Based Research	06/09/08	1/2 (50%)
Research With Protected Populations - Vulnerable Subjects: An Overview	06/09/08	3/4 (75%)
International Research - SBR	06/09/08	4/4 (100%)
Group Harms: Research With Culturally or Medically Vulnerable Groups	06/09/08	2/3 (67%)
Workers as Research Subjects-A Vulnerable Population	06/09/08	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	06/09/08	2/2 (100%)
Air Force Research Laboratory	06/09/08	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

CITI Collaborative Institutional Training Initiative

Basic/Refresher Course - Human Subjects Research Curriculum Completion Report
Printed on Thursday, June 5, 2008

Learner: Edward White (username: edw3)
Institution: Air Force Research Laboratory
Contact Information Phone: 937-255-3636 ext. 4540
Email: edward.white@afit.edu
Air Force Research Laboratory (AFRL):

Stage 1. Basic Biomedical course Passed on 06/04/08 (Ref # 1850662)

Required Modules	**Date Completed**	**Score**
Belmont Report and CITI Course Introduction	06/03/08	3/3 (100%)
History and Ethical Principles	06/03/08	4/5 (80%)
Defining Research with Human Subjects - SBR	06/03/08	3/5 (60%)
Basic Institutional Review Board (IRB) Regulations and Review Process	06/03/08	5/5 (100%)
Informed Consent	06/04/08	4/4 (100%)
Privacy and Confidentiality - SBR	06/04/08	3/5 (60%)
Social and Behavioral Research for Biomedical Researchers	06/04/08	4/4 (100%)
Records-Based Research	06/04/08	1/2 (50%)
Research With Protected Populations - Vulnerable Subjects: An Overview	06/04/08	2/4 (50%)
International Research - SBR	06/04/08	4/4 (100%)
Group Harms: Research With Culturally or Medically Vulnerable Groups	06/04/08	3/3 (100%)
Workers as Research Subjects-A Vulnerable Population	06/04/08	3/4 (75%)
Conflicts of Interest in Research Involving Human Subjects	06/04/08	1/2 (50%)
Air Force Research Laboratory	06/04/08	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

CITI Collaborative Institutional Training Initiative

Basic/Refresher Course - Human Subjects Research Curriculum Completion Report
Printed on Thursday, May 8, 2008

Learner: Al Thal (username: athal)
Institution: Air Force Research Laboratory
Contact Information Email: al.thal@afit.edu
Air Force Research Laboratory (AFRL):

Stage 2. AFRL Refresher Passed on 05/08/08 (Ref # 1788323)

Required Modules	Date Completed	Score
Refresher Course 101 Introduction	05/08/08	no quiz
101 Refresher Course - History and Ethics	05/08/08	2/2 (100%)
101 Refresher Course - Regulations and Process	05/08/08	3/3 (100%)
101 Refresher Course - Informed Consent	05/08/08	2/2 (100%)
101 Refresher Course - Social and Behavioral Research	05/08/08	2/2 (100%)
101 Refresher Course - Records Based Research	05/08/08	no quiz
101 Refresher Course - An Overview of Research with Vulnerable Subjects	05/08/08	2/2 (100%)
101 Refresher Course - Complete the course	05/08/08	no quiz
Group Harms: Research with Culturally or Medically Vulnerable Groups.	05/08/08	3/3 (100%)
HIPAA and Human Subjects Research.	05/08/08	2/2 (100%)
Air Force Research Laboratory	05/08/08	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Basic/Refresher Course - Human Subjects Research Curriculum Completion Report
Printed on

Learner: Michael Grimaila(username: michaelgrimaila)
Institution: Air Force Research Laboratory
Contact Information Email: Michael.Grimaila@afit.edu
Air Force Research Laboratory (AFRL):

Stage . Basic Biomedical course Passed on 01/05/09 (Ref # 2132917)

Required Modules	**Date Completed**	**Score**
Belmont Report and CITI Course Introduction	01/05/09	3/3 (100%)
History and Ethical Principles	01/05/09	6/7 (86%)
Defining Research with Human Subjects - SBR	01/05/09	5/5 (100%)
Basic Institutional Review Board (IRB) Regulations and Review Process	01/05/09	5/5 (100%)
Informed Consent	01/05/09	4/4 (100%)
Privacy and Confidentiality - SBR	01/05/09	3/4 (75%)
Social and Behavioral Research for Biomedical Researchers	01/05/09	2/4 (50%)
Records-Based Research	01/05/09	2/2 (100%)
Research With Protected Populations - Vulnerable Subjects: An Overview	01/05/09	4/4 (100%)
International Research - SBR	01/05/09	4/4 (100%)
Group Harms: Research With Culturally or Medically Vulnerable Groups	01/05/09	3/3 (100%)
Workers as Research Subjects-A Vulnerable Population	01/05/09	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	01/05/09	2/2 (100%)
Air Force Research Laboratory	12/17/07	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

A COMPARISON OF THE U.S. AIR FORCE FITNESS TEST AND

SISTER SERVICES' COMBAT-ORIENTED FITNESS TESTS

Acronyms Guide

AAPHERD = American Association for Physical Education, Recreation, and Dance

ABU = Airman's Battle Uniform

ACSM = American College of Sports Medicine

AFB = Air Force Base

AFM = Air Force Manual

AFP = Air Force Pamphlet

AFPFT = Air Force (general) Physical Fitness Test

AFR = Air Force Regulation

AFROTC = Air Force Reserve Officer Training Corps

AFSC = Air Force Specialty Code

AFSO21 = Air Force Smart Operations for the 21st Century

AHA = American Health Association

AFI = Air Force Instruction

AFIT = Air Force Institute of Technology

AL = Ammunition-Can-Lift (drill within the CFT)

AMA = American Medical Association

ANOVA = Analysis of Variance

AOR = Area of Responsibility

APFT = Army Physical Fitness Test

APRT = Army Physical Readiness Test

BCT = (Army) Basic Training

BDU = Battle Dress Uniform

BMI = Body Mass Index

CC/-s = commander/-s

CFT = (Marines) Combat Fitness Test

CG = control group

CST = Combat Skills Training

DoD = Department of Defense

EG = experimental group

FCE= Functional Capacity Examinations

FM = (Army) Field Manual

HAWC = Health and Wellness Center

HSD = Highly Significantly Different (from Tukey-Kramer statistical analysis)

HWQ = Health Screening Questionnaire

ILO = In-Lieu-Of (tasking)

IRB = Institutional Review Board (for human subjects testing approval)

JET=Joint Expeditionary Tasking

JIT = Just-In-Time (training)

km = kilometer

MANUF = Maneuver-Under-Fire (drill within the CFT)

MFTC = Master Fitness Trainer Course

m = meter

MOS = Military Occupational Specialty (within the Army)

MTC = Maneuver-To-Contact (drill within the CFT)

OCC = Occupational Classification

PASGT = Personal Armor System for Ground Troops

PCACFAY = President's Citizen's Advisory Committee on the Fitness of American Youth

PCPF = President's Council on Physical Fitness

PCS = permanent change of station

PCYF = President's Council on Youth Fitness

PRT = Physical Readiness Training, or Physical Readiness Test

PT = Physical Training

RBA = Ranger Body Armor

ROTC = Reserve Officer Training Corps

SABC = Self-Aide and Buddy Care

SAPI = Small Arms Protective Inserts (prefix E, "enhanced", or X, next generation)

SCET = sub-maximal cycle ergometry testing

SSE = sum of squared error (from Breusch-Pagan test)

SSR = sum of squared residual (from Breusch-Pagan test)

UFPM = Unit Fitness Program Monitor

USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

USAF = United States Air Force

US = United States

VIF = variance inflation factor

VO2 = volume of oxygen (uptake)

WFFC = Wright-Field Fitness Center

WPAFB = Wright-Patterson Air Force Base

WWI = World War One

WWII = World War Two

XBX = Ten Basic Exercises Program

5BX = Five Basic Exercises Program

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Vita

Captain Thomas E. Worden graduated from Central Bucks High School West in Doylestown, Pennsylvania. He entered undergraduate studies at Cornell University in Ithaca, New York and graduated with a Bachelor of Science degree in Civil Engineering, with a minor in Mechanical Engineering and a concentration in Architecture, in May 2004. He was commissioned through the Detachment 520 AFROTC at Cornell University after being nominated for a Regular Commission.

His first assignment was to the 30th Civil Engineer Squadron at Vandenberg AFB, California in August 2004, where he served as a unit deployment manager, Prime Base Engineer Emergency Force (BEEF) officer-in-charge, project programmer, and mission engineer. In June 2006, while stationed at Vandenberg, he was sent to CST at Fort Bragg, North Carolina to fill an indeterminate Army ILO engineer tasking to Afghanistan. He deployed to Bagram Air Field with the Bagram Provincial Reconstruction Team (PRT) as the lead team engineer, and accumulated over 50 combat missions in eight months. In August 2007, he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to the 51st Civil Engineer Squadron, Osan Air Base, Korea.

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14. ABSTRACT

This research explores how the United States Air Force Physical Fitness Test (AFPFT) events compare to sister-services' physical fitness test events with respect to their predictability of combat capability. Multiple regression tools, non-parametric analyses, and chi^2 contingency table hypothesis testing were utilized to test hypotheses about performances and determine associations between involved variables.

AFPFT scores had minimal predictability (adj R^2 0.2045) [but improved when raw data replaced scoring sheets, pushups have no maximum, and abdominal circumference and age are removed (adj R^2 0.7703)]. Higher Body Mass Index (BMI) predicts higher combat capability (p-value 0.0208). The best two-event model incorporated a 1/2-mile run and 30-lb. dumbbell lifts (adj R^2 0.8514), and the best three-event model also incorporates pushups with no maximum (adj R^2 0.8819).

Completion of the fireman's carry has a dependency on both BMI >25 (p-value 0.00152) or a waist >32.5" (p-value 0.00521). Improvement in peer stratifications from the AFPFT to combat capability has a dependency on BMI >25 (p-value 3.19E-7), even with abdominal circumference excluded from the scoring (p-value 0.00586). Women were found to have lower combat capability than men (p-value 0.0003). Those who could not pass the fireman's carry were found to have lower combat capability (p-value 0.0002).

15. SUBJECT TERMS

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