STUDY PROJECT

PEACETIME PHYSICAL FITNESS AND ITS EFFECT ON COMBAT READINESS AN AIR FORCE PERSPECTIVE

BY

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USAWC MILITARY STUDIES PROGRAM PAPER

PEACETIME PHYSICAL FITNESS AND ITS EFFECT ON COMBAT READINESS AN AIR FORCE PERSPECTIVE

AN INDIVIDUAL STUDY PROJECT

by

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America is rapidly becoming a nation of soft out of shape men and women who can not endure, for an hour, the kind of stress that our ancestors faced daily. Today, the typical American is older physically than years give him the right to be. Fitness in the military is a time-honored and unquestionable axiom. Yet, there is little objective knowledge as to what criteria of fitness are necessary to maintain combat readiness. More than ten years ago it became apparent that, from a physical fitness/healthy lifestyle perspective, the military was not in an optimal readiness posture. In February 1980, the President requested the Secretary Of Defense provide him an assessment of the Services physical fitness programs. This request led to a Department Of Defense symposium on military fitness in June 1980. The symposium reviewed existing fitness policies and programs. The result of the symposium, was a revised DOD Directive 1308.1; Physical Fitness and Weight Control. Was this enough? Are the current peacetime physical fitness programs effective? Do they adequately prepare our military to withstand the rigors of combat? This individual study project reviews these and other questions about the services peacetime physical fitness programs. Fitness is defined, guidance is reviewed, current efforts are analyzed to determine their validity, and recommendations are provided --- all from an Air Force perspective.

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INTRODUCTION

In today's armed forces, physical fitness is a vital component of combat readiness, and must be an integral part of every service members life. Readiness begins with the physical fitness of the individual soldier or airman, and the NCO's and Officers that lead them. The experiences in Grenada, the Falkland Islands, Panama, and now in the Gulf underscore this statement. The renewed interest in fitness nationwide has been accompanied by many research studies exploring the effects of good fitness programs. The overwhelming conclusion is that physical fitness programs are essential in order for military personnel to withstand the rigors of combat.

More than ten years ago it became apparent that, from a physical fitness/healthy lifestyle perspective, the military was not in an optimal readiness posture. The DOD Symposium on Physical Fitness in 1980 addressed military physical fitness issues, and the DOD Health Promotion Conference in 1983 addressed broader issues of promoting more healthy lifestyles for military personnel and their families. No one argues against the need for physical fitness in the military. The issues that are often debated are what standards of measurement should be used to determine the prescribed level of fitness, and are our peacetime physical fitness programs adequately preparing our soldiers for combat?

This individual study project will review these and other

questions about the services' peacetime physical fitness programs. Fitness is defined, guidance is reviewed, current efforts are analyzed to determine their validity, and recommendations are provided from a Commanders perspective.

Good physical fitness is the goal of each of our military services. To review all aspects of each program would be laborious and too large for any reasonable project. Therefore, in an effort to limit the volume of this study, the issues addressed are primarily from an Air Force perspective.

WHAT IS PHYSICAL FITNESS AND HOW IS IT DETERMINED?

Physical fitness is a complex concept that often means different things to different people. Physical fitness refers to an enhanced physiological or functional capacity that allows for improved performance. As physiology functional capacity increases, the capacity for exercise increases.[1] In other words, a person can lift heavier weights, run faster or just plain exercise more. Increased physical fitness is often reflected by physiological adaptations such as a lower heart rate during a standardized exercise test. A high level of physical fitness enables us to perform required daily tasks without fatigue.

The development of a high degree of motor skill is sometimes confused with physical fitness.[2] Motor skills proficiency and physical fitness are not necessarily related. A highly skilled person may have a low level of physical fitness, and the reverse may also be true. There are several major components of physical fitness. Each component is of equal importance, and no one component should be emphasized over the other. Physical fitness is generally recognized as being composed of:

1. **Cardiorespiratory endurance (aerobic power)**-Efficiency with which the body delivers nutrients, and oxygen needed for muscular activity, and transports waste products from the cells, during sustained operations.[3]

2. **Muscular strength** - Greatest amount of force a muscle or muscle group can exert in one movement, or contraction.[4]

3. **Muscular endurance** - The ability of a muscle or muscle group to perform repeated movements with moderate resistance for given periods of time.[5]

4. **Flexibility** - Ability to move the joints through an entire (normal) range of motion. An adequate degree of flexibility is important to prevent injury and to maintain body mobility.[6]

5. **Body composition** - Two major elements; lean body mass, which includes muscle, bone, and essential organ tissue; and body fat. Lean body mass represents the metabolically active part of the body that makes a direct and positive contribution to energy production. Body fat represents tissue that stores the energy for use during some forms of exercise, but otherwise does not contribute directly to performance.[7]

The first four components have an impact on body composition. An important component of body composition is weight control. Other aspects, such as speed, agility, coordination, and balance, are properly classified as components of motor skill. Each affects individual survivability. Appropriate training can improve these components within an individual's inherited physical capacity.

The ability to perform physically demanding tasks is a function of two broad features; 1) the capacity for muscular contraction and 2) the neural control of body movement. This first feature, commonly referred to as "physical fitness", represents the metabolic or energy generating capacity for muscular exercise.

In this context, physical fitness can logically be divided into three separate sources of energy (ie, metabolic systems) for

muscle cell, 2) energy generated by the breakdown of muscle-stored glycogen into lactic acid, and 3) energy resulting from the aerobic metabolism of various substrates, referred to as the citric acid cycle and respiratory chain.[8]

Each source is associated with a type of exercise described by it's intensity and duration, for example, energy from anaerobic glycolysis occurs in very heavy exercise lasting less than one minute. Aerobically generated energy through the citric acid cycle and respiratory chain is associated with prolonged exercise of a submaximal intensity.[9] In real life tasks, or athletic performance, these fitness or energy generating components overlap, that is, most tasks involve more than one energy source. Nevertheless, they can be separated to a large extent for measurement and training.

Among the many components comprising "physical fitness", the most important for predicting one's ability to perform strenuous total body exercise for a prolonged period of time is a measure of aerobic capacity known as Maximum Oxygen Uptake (Vo2 max). The determination of a given individual's Vo2 max is technically demanding and not without considerable risk to the subject, since it requires continuous exercise to the point of total exhaustion. On the other hand, this important physiological parameter may be estimated quite accurately from cardiovascular responses to standard, submaximal exercise.[10]

In the 1960's, Dr.(LTC) Ken Cooper researched cardio-respiratory endurance while on active duty in the U.S. Air Force. His detailed research popularized scientific information developed by Astrand and other physiologists about human physiology. Information, that was previously reserved for medical students and exercise physiologists, was explained in laymans terms for all to read and understand. He explained that cardiorespiratory endurance, generally recognized as aerobics, depends on the diffusion of oxygen from the air sacs of the lungs through the pulmonary capillaries and into the working muscle cells. Aerobic fitness is the ability to take in, transport, and use this oxygen.[11] This process depended on maximal oxygen uptake, and was used to evaluate how efficiently an individual uses oxygen. Oxygen consumption was related to active muscle mass and equated by dividing oxygen consumption (measured in milliliters consumed per minute) by body weight (measured in kilograms). As a point of reference, the average male college student uses 44 to 48 milliliters per kilogram per minute (ml/kg/min) of oxygen, and the average female student uses 37 to 41 ml/kg/min.[12] These values were derived through costly time-consuming laboratory procedures. Dr. Cooper's trail blazing "Aerobics" provided an alternative measuring method with a coefficient of correlation of 0.80 or 80% accurate. This aerobics program placed individuals into fitness categories (very poor, poor, fair, good, excellent) based on oxygen consumption.

Another less traumatic method of correlating Vo2 max and

cardiorespiratory endurance is through a cycle ergometer (a research grade stationary bicyle) test. Basically, the cycle ergometer, or for that matter any physical exercise, can be evaluated for effectiveness by correlating Vo2 max against the training heart rate as an indicator of energy being expanded and oxygen being consumed.[13] By employing the Karvonen method, (a method developed by Kentala Karvonen for calculating the maximal heart rate reserve (HRR), where HRR = HR_{max} - HR_{rest}) a conversion of a percent of maximum heart rate to an equivalent percent of Vo2 max can be made. At a minimum of 70% maximum heart rate, a "training threshold" is reached. At approximately 80% maximum heart rate, a range of anaerobic exercise or oxygen debt exercise is reached. Exercise at more than 80% heart rate leads to decreasing performance because an oxygen debt in the muscle cells develops, and the muscle fatigues.[14] Optimum training occurs when exercising between 60 and 80% maximum heart rate. This is in the training zone where oxygen is replenished and muscle is revitalized. At the lower end of the training zone (60-75%), the predominant training effort is muscular strength. While at the upper end (76-80%), the predominant training effect is endurance.[15]

So what's the point? The fitness level, particulary the aerobic capacity, of our military members relates directly to their ability to sustain themselves in combat. Being in shape to fight, after intense bouts of fatigue and mental stress, is the whole idea behind the need for peacetime physical fitness

programs. To what level, is a debatable question, since not everyone will be expected to perform the most strenuous tasks...or will they?

GUIDANCE - WHAT HAVE WE BEEN TOLD TO DO ?

Throughout the history of Armed Forces, physical fitness has been a common concern of commanders. The exponential increase in health promotion awareness, in the last two decades, has been paralleled by the development of programs within the military to educate its people and to develop strong physical fitness programs and healthy lifestyles.

> "The preservation of America's freedom is dependent on a strong defense. Our Armed Forces must be mentally and physically prepared at all times, leaving no doubt about this nation's will and ability to defend itself. For this reason, it is necessary to reaffirm the importance of physical fitness. Even with today's modern weapon systems it is the service man and woman who are physically, mentally and spiritually ready to serve their country who will make the difference in any future conflict."[16]
>
> Ronald Reagan
> December 10, 1982

In February 1980, the President requested the Secretary of Defense provide him an assessment of the uniformed services physical fitness programs. This request led to a DOD symposium

on military fitness in June 1980. The symposium reviewed existing fitness policies and practices. As a result of the symposium, a revised DOD Directive (DODD) 1308.1; Physical Fitness and Weight Control, was published in June 1981.[17]

The revised DODD 1308.1 required each service to design and implement a physical fitness program consistent with established principles of physical conditioning. The program could be tailored to the specific needs and mission of the service. Additionally, the military services were tasked to design and utilize physical fitness tests that, as a minimum, evaluate stamina or cardiorespiratory endurance. Finally, the services were to provide an assessment of the physical fitness of their military members. The new DODD 1308.1 also directed the military services to adopt the following physical fitness policy:

> Physical fitness is a vital component of combat readiness and is essential to the general health and well being of the armed forces. Individual service members must possess the stamina and strength to perform successfully any potiental mission. These qualities, together with weight control, form the basis of the DOD physical fitness program.[18]

Clearly, the directive considers physical fitness essential for combat readiness. The primary emphasis should therefore be focused on quality peacetime programs to develop and maintain physical fitness. Of secondary importance, is the need for evaluation and testing. In addition to the provisions of DODD

1308.1, DODD Directive 1010.10; Health Promotion, assists in establishing a health promotion policy within the Department of Defense. Specifically to improve and maintain readiness and the quality of life for DOD personnel. It further encourages military personnel, retirees, their families and civilian employees to live healthy lives through integrated, coordinated and comprehensive health programs.

DODD 1010.10 establishes plans and programs to address physical fitness, smoking cessation, nutrition, stress management, alcohol and drug abuse, and early identification of hypertension. The physical fitness programs aim to encourage and assist all target populations to establish and maintain the physical stamina necessary for better health and a more productive lifestyle.[19] Further, commanders and managers should assess the availability of fitness programs at or near work sites, and should consider integrating fitness regimens into normal work routines for military personnel as operational commitments allow. Finally, DODD 1010.10 directs each military service to establish a Health Promotion program coordinator to serve as the focal point for all health promotion issues.

Last in the series of Department of Defense Directives is DODD 6055.6; DOD Fire Protection Program. This directive is particularly interesting since it's the first of a kind that actually "directs" a fitness program on a specific career field, Military Firefighters. It states that since all DOD firefighting

positions are defined as rigorous, firefighters shall participate in a physical fitness exercise program designed to maximize job performance.[20]

This directive was revised to include the mandatory physical fitness program following a research study to determine the physical fitness of the Air Force Firefighters. In this research study, it was determined that search and rescue operations were too strenuous for the majority of firefighters. "An alarmingly high percentage of professional Air Force Firefighters lacked the physical strength and stamina, to successfully perform critical tasks related to their mission".[21] These same firefighters had successfully passed their annual physical fitness evaluation a few months earlier.

DOD direction seemed clear. The services were to develop peacetime fitness programs to improve stamina and strength, while maximizing mission requirements. But are they there? It would appear that the current Air Force Physical Fitness Program isn't even close! Can it be improved to comply?

THE AIR FORCE PROGRAM

AFR 35-11 defines the Air Forces fitness program. The purpose of which is to encourage individuals to participate in a year round conditioning program. Further, it periodically evaluates

the fitness level of Air Force members to ensure they are physically prepared to support all military operations, exercises, or other contingencies. Compliance is an individual responsibility.22 AFR 35-11 seems to meet the minimum requirements of DODD 1308.1. However, the Department of Defense Directive starts with the development and maintenance of physical fitness as the primary emphasis, and follows with weight control as a supplement to this fitness objective. The Air Force focus, on the other hand, is on weight management which is supplemented by a fitness program. This transfer of program objectives reflects a departure from a proactive DOD physical fitness effort to a more reactive Air Force approach.

The objectives of the Air Force fitness program are: 1) ensure Air Force members are physically fit for military duty; 2) establish fitness standards which promote the well-being of all members, without undue health risks; and 3) support total force readiness. These objectives mirror the DODD 1308.1 objectives. However, the Air Force approach centers on evaluation and not on development. The program is currently under revision, and has been since 1970. The current program does not appear to be contributing to the fitness requirements of the Air Force people and mission.

In August 1982, the Air Force formed a special office at the Air Force Military Personnel Center (AFMPC) to review Air Force fitness, the regulation and the fitness level of the Air Force

member. To assist the special office, a fitness advisory council was established. It was comprised of Air Force physicians, physiologists, dietitians, and related program managers. In October 1982, AFMPC hosted a command workshop on fitness to develop recommendations to improve the Air Force fitness regulation. The workshop recommendations were briefed to staff members of the Air Force Deputy Chief of Staff for Manpower and Personnel (DCS/MP) in November 1982. The special office was then tasked to incorporate the recommendations into a low cost, effective, "enhanced" program proposal.[23]

The enhanced program was briefed to the DCS/MP in January 1983 and to the Air Force Chief of Staff and Vice Chief of Staff in March 1983. The Vice Chief approved the enhanced concept, and authorized AFMPC to release the proposal to the Major Air Commands (MAJCOM) for review and comment. The MAJCOMs provided recommendations concerning the enhanced proposal. During the summer of 1983, using the new proposed standards, about 2,200 active duty Air Force members from 22 installations were tested to evaluate the new program, and to determine an Air Force fitness baseline. During the first phase, no advanced notice was given prior to testing. The evaluation included bodyweight measurements, a 1.5 mile run, and a one minute situp test. During the second phase, 18,000 personnel at seven locations received advanced notice and training, and then were evaluated on bodyweight, a 1.5 mile run, and a one minute sit-up test.[24] The documentation of the results were not made public. However,

the first phase showed that the individuals tested could not meet the enhanced standards. The group with the advanced notice could. The enhanced program was then field tested at six conus installations and one remote site from January thru August 1984.

MAJCOM's recommended additional modifications to the program to minimize the manpower impact of administering it. The Air Force began finalizing an effective program which would be safe, feasible, and acceptable for Air Force wide implementation in 1986.

This program has been dynamic, to say the least, with additions and deletions in October 1986, August 1987, September 1987, September 1989, and December 1989. However, as of March 1991, it has yet to be fully implemented. Clearly, the physical conditioning program within the Air Force merits increased attention. It is generally believed that one of the major concerns, with the enhanced program implementation, is that even with the advanced notification, the more senior members failed to meet minimum standards. This, together with the policy of placing individuals who fail their annual PT test on the Commanders Management Roster, would present tremendous retention problems for the Air Force. Additionally, the increased costs to implement the program and to continue to monitor members who failed, also contributes to the apparent hesitation to implement it.

The results of all of this indicates that a renewed emphasis in the physical conditioning of the Air Force members is required throughout the chain-of-command. The education of Air Force leaders regarding physical fitness training is essential if we are to progress in developing a more physically fit and combat ready force.

FITNESS vs PERFORMANCE

Fitness in the military is a time-honored and unquestionable axiom. Yet, there is limited objective knowledge as to what criteria of fitness are necessary to maintain combat effectiveness. The first real test of your peacetime physical fitness program may be in combat. This would be the wrong time and place to find weaknesses. Most people would agree that members of the armed forces should be in good physical condition. For most on active duty in the Air Force, however, compulsory organized physical activity ends after basic training. Additionally, perceptions of the connection between fitness and the operational art of warfighting vary.

Does the Air Force Fitness Program achieve Air Force Fitness objectives? In an Air War College survey completed in November 1987, 45.4 percent of the individuals that responded said "no" and 26.1 percent were uncertain. Of the 28.4 percent who responded in the affirmative, only 3.2 percent characterized

their view as "strong". This survey included the Air Command and Staff College class, the Air War College class, and the Senior NCO Academy class.25

Air Force regulations prescribe physical fitness based primarily on aerobic conditioning. While individual commanders can require on-duty physical training, the program for most Air Force personnel appears to be individual and voluntary. Members are tested annually to determine if they meet standards.

If we are to have a force ready for combat, it is important to know the relationship between various modes of peacetime training and the physical requirements of our combat soldier, sailor, or airman. Most analysts identify "endurance" as the first physical requirement of combat, and there have been numerous studies done to refine this belief.

Take for example a study by Captain Joseph Knapik et al. in 1989, on the physiological factors in infantry operations.[26] Male infantry soldiers were studied before, during, and after a 5-day simulated combat exercise. Prior to the exercise, measures of body composition and maximum oxygen uptake (Vo2) were obtained. Before and after the exercise, the Army Physical Fitness Test (APFT) and various measures of anaerobic capacity and muscular strength were determined. The results showed no significant decrement in field performance during the exercise. A major finding of the study, however, was the reduced upper-body

anaerobic capacity and strength following the exercise[27]

A second major finding of the study was the relationship between the individual performance scores and the physiological measurements. The study showed that upper-body anaerobic capacity and strength declined following the exercise. The results concluded that upper-body strength and anaerobic capacity appear to be important for infantry operations. These results correlate with reports on the British campaign in the Falklands and American actions in Grenada. They all conclude that physical fitness was an important factor in the success of these operations.[28] Figure 1 below displays the physical characteristics of the study group both before and after the study.

STUDY CHARACTERISTICS / RESULTS (mean values)

	Pre-test	Post-test
Sit-ups	66.8	61.6
Push-ups	66.0	59.8
2mi run	14.4	15.6
*AFPT score	269	247
Rifle score	27.6	27.5

Figure 1.
*Army Physical Fitness Test

The importance of physical fitness in the military and particularly in the infantry, is well documented. However, do the current peacetime physical fitness programs accurately

determine what level of fitness is necessary to maintain combat effectiveness during sustained operations?

In this aspect, Myles et al., after reviewing the various fitness tests used by the Canadian Forces, recommended that fitness tests for combat forces be developed on the basis of occupationally related tasks and assessment of the fitness components necessary to perform these tasks.[29] In 1978, the Directorate of Military Occupational Structures began the process of identifying and quantifying the most physically demanding tasks of the trades involved in the Canadian Forces. The trade specifications state that an infantryman must be able to participate in offensive and defensive operations including advances, attacks, crossing obstacles, rescuing casualties, constructing defenses and individual movements with a weapon.[30] As a result of these evaluations, 15 tasks were determined necessary for the combat infantryman. These findings, along with those of United States researchers, indicate that the majority of the strenuous tasks involve the physical handling of material. Thereby, primarily upper-body strength and muscular endurance was required. An Indoor Standardized Obstacle Course (ISOC) was developed to task the relevant fitness components. To determine the correlation of the course, 43 military males were evaluated. Prior to running the course, the subjects were first assessed for aerobic power, anaerobic lactic power, and muscular strength and endurance.

The analysis of data indicated, among other items, that there was a significant correlation with performance on the ICOS with Vo2 max, and anaerobic lactic power.[31] It was concluded that ISOC performance was significantly associated with those fitness components accepted as important in the performance of wartime tasks. Moreover, the test appeared to be a valid test of the occupational fitness of infantry personnel.

Do current physical fitness programs properly evaluate combat performance? A recent study conducted by the United States Marine Corps suggests that at least their program does. To relate their test to actual combat tasks, they too gathered data about the tasks associated with their most common Military Occupation Speciality (MOS), the infantryman. They compared these tasks to their annual Physical Fitness Test (PFT). They monitored this MOS in environments closely related to real combat operations. A team of exercise physiologists went along with a Marine Corps fire team to the Mountain Warfare Training Center in Bridgeport, California. After six days of testing, the study concluded that there was a direct relationship between the Marine Corps PFT and the infantryman's combat tasks.[32] Those Marines who scored very high on the PFT also had superior scores on the combat task test. The study suggests that while the PFT is a good first screen to determine combat readiness, the scoring system should be changed to better reflect the contribution provided by each test (sit-ups, push-ups, etc.).

The need for a comprehensive physical fitness program that improves the combat readiness of the individual member is clearly and consistently documented. Physical fitness does have a direct relationship with combat readiness. The more physically fit the individual, the greater his/her chances are of accomplishing the mission. The real challenge therefore is to develop the proper peacetime physical fitness program that will insure the individual is prepared for combat. Study after study has evaluated the different services fitness programs. Results are mixed as to whether these programs, as currently applied, really prepare the member for combat. Most researchers agree that an evaluation of the "combat tasks" are necessary so that the proper peacetime program can be developed.

The identification and development of these combat tasks is therefore an overriding objective. Within the Air Force, the Air Force Engineering and Services Center (AFESC) has been doing just that. Starting with the Air Force Firefighters in 1983, AFESC identified a significant weakness in their peacetime conditioning program, and implemented changes to correct it. Field studies to determine the metabolic costs of performing search and rescue operations have resulted in a major breakthrough in peacetime physical training programs .... **a mandatory physical fitness program, performed while on duty!**

The intent of the first AFESC study was to collect data representative of the workloads imposed on Air Force

Firefighters,and to develop valid laboratory protocols to simulate the physical stresses of firefighting activities. These protocols would than be used to evaluate firefighter protective equipment. The results of the study confirmed earlier subjective observations that firefighters activities, particularly search and rescue operations, imposed severe physical workloads. As previously discussed, it was also found that an alarmingly high percentage of professional Air Force Firefighters lacked the physical strength and stamina to successfully perform these critical combat tasks.

The experience gained in this study made a subsequent study of firefighter fitness essential. Individuals from Grand Forks Air Force Base volunteered to be the first to evaluate the status of physical fitness of the Air Force firefighter. The results were briefed at the annual Strategic Air Command (SAC) Base Civil Engineers Conference in 1983. The concern for Air Force Firefighter fitness was evident. To preclude the possibility that the low level of physical fitness demonstrated by the personnel at Grand Forks AFB was not unique, the study was expanded to include a larger number of AFB's. The Fire Chiefs at Ellsworth, Randolph, and Plattsburg AFB's volunteered to have their personnel tested.

The determination of each volunteer's Vo2 max was accomplished using the procedures outlined in the Astrand-Rhyming nomogram for

the cycle ergometer.[33] Body density was determined by hydrostatic weighing in a quiet swimming pool.

Physical Characteristics Of Air Force Firefighters At Grand Forks AFB (mean values)

Age Group (years)	No.	Height (inches)	Weight (lbs)	Vo2 max (ml/kg/min)
18-19	9	70.2	165.1	40.7
20-29	25	70.2	183.4	33.8
30-39	10	70.2	193.1	31.8
40-49	1	70.0	197.0	20.1

Figure 2.

In reviewing these results, one must keep in mind that Air Force firefighters are engaged in an occupation which imposes an emergency requirement in the defense of life and property. Thus, it is paradoxical that the fitness levels (Vo2 max) of the Grand Forks Firefighters are consistently below that for sedentary men. The 20-29 year old group were found to have Vo2 max values averaging only 33.8 ml/kg/min, consistently below the average of 45.4 for sedentary men of the same age group.[34] This relatively poor fitness level persisted throughout all age groups

and, combined with their disappointing performance in the standard search and rescue exercises, was cause for serious concern.

The results of the more comprehensive larger study revealed that the average Air Force firefighter was above average in body fat content and below average in Vo2 max.[35] The mean values used in reporting the results tended to shield the poorer performers, but it takes little imagination to project the fitness future of a firefighter who, in his twenties, is already only as fit as an average 70 year old man.[36]

The intent of this study was not only to evaluate the current physical condition of Air Force Firefighters, it was also to establish a baseline fitness value for the firefighter, and to provide each a individualized exercise "prescription" to improve both cardiovascular and muscular fitness. A training program was prepared, and it was planned to observe changes in fitness at regular intervals (4 months) over a one year period. The program centered on using the cycle ergometer (Monark 868) in conjunction with muscular strength exercises with a universal gym or free weights.[37] The results of this training program are reflected in figure 3.

"Summary of Effects of Firefighter Conditioning Program"

	Start	12 mon.	% change
body weight (lbs)	181.09	181.17	0.0
Vo2 max (ml/kg/min)	37.7	43.9	+16.7
body fat (%)	21.5	15.5	-27.9

Figure 3.

The 16.7% average improvement in Vo2 max and the 27.9% decrease in body fat were most notable.[38] The results of this study seemed to confirm the effectiveness of a mandatory physical fitness program.

Was the lack of fitness levels limited to Air Force Firefighters? Apparently not. In October and November 1988, the physical fitness of 6,022 active duty Army soldiers identified some serious concerns.[39] The U.S. Army Physical Fitness School went to 14 Army installations to administer the APFT. While the results were generally good, some of the highest failure rates and lowest maximum rates were found within the youngest age groups (17-21 yrs and 22-26 yrs).[40]

The result of this study was also cause for concern. Logically, it might be expected that younger soldiers would be generally more fit than their older counterparts as was the case in the aforementioned Air Force study. Based solely upon the APFT performance, a large and unacceptable percentage of U.S.

Army soldiers under age 35, may not possesss the cardiovascular endurance or muscular strength necessary to withstand prolonged combat.[41]

Now, can the results of these studies be applied to a typical Air Force Civil Engineering Squardon whose wartime mission is Rapid Runway Repair (RRR)? This RRR mission involves expedient repairs to bomb damaged runways by covering the craters with AM-2 aluminum matting assembled in a staggered brickwork pattern. It is generally accepted that RRR activities are a very strenuous physical task. Therefore, the successful completion of this requirement depends greatly upon the individual physical fitness of the men and women involved. The most strenuous task, that of lifting and assembling the mats, was part of a Myhre et al. study in which the metabolic costs of rapid runway repair activities were determined.[42] In this study individuals were evaluated while taking part in their annual field training exercise. The subjects ranged in age from 21 to 40 years of age, and had an average weight of 212 lbs. During the study, the metabolic costs of performing these activities were obtained, and validated earlier assumptions that the most strenuous task is that of lifting and assembling the AM-2 mat patches. Relative to the tests subjects bodyweights, the mat laying activities required an average of 22ml/kg/min (Vo2 max).[43]

How can this information be used to determine what effect an individuals physical fitness has on completion of this combat

task? By using the Vo2 max previously identified for the average sedentary male, (45 ml/kg/min) one can determine that the average individual would be working at approximately 50% of his maximum capacity while assembling the AM-2 mat. (22/45 = 48.88%) Thus an individual should be able to sustain this effort for a rather long peroid of time. However, if we use an individual with a Vo2 max (as represented by the Air Force Firefighter study) of 33.8 ml/kg/min, the individual would be working at 65% of his maximum capacity. (22/33.8 = 65.08%) This individual will not be able to maintain the pace needed to repair damaged runways during combat.

SUMMARY / CONCLUSIONS

As members of the U.S. Armed Forces, we have a tremendous responsibility... the defense of America and the preservation of freedom and democracy. We all take a great deal of pride in looking at ourselves as professionals in a modernistic, high technology, computerized organization. However, the bottom line is that we are a fighting force that must be combat ready to accomplish our mission under sustained operations. The only way to do this is to be as physically fit as possible.[44] Physical fitness has always been linked to combat readiness. However, a major Department of Defense (DOD) study found that none of the military services could accurately measure the fitness level of their members. They could not provide appropriate fitness programs to service members of all ages and sex. They did not

have adequate in-house physical fitness expertise. And they did not incorporate physical fitness knowledge into their peacetime training programs.45 The resultant revision to DODD 1308.1 required the services to correct these deficiencies.

Readiness in the Air Force begins with the physical fitness of each individual. A renewed emphasis on physical fitness has come about as a result of the realization that combat readiness is significantly improved by the enhancement of physical conditioning. Experience and scientific research have repeatedly shown that the physical qualities of strength and endurance, increase with improved physical training.46 While the physical demands of Air Force specialties differ, each and every member must possess the physical ability to endure, to withstand stress, and to carry on when an unfit person can not. Physically fit individuals are also more resistant to illness and disease and quicker to recover from injury than are unfit individuals.

Clearly, the Air Force needs an effective physical fitness program not only to comply with Department of Defense Directives, but to improve individual fitness and therefore combat effectiveness. The current Air Force program is not perceived to be effective. Numerous studies, like the evaluation of Air Force Firefighters, reveals a failure to adequately test aerobic fitness. Finally, because many Air Force members seem to be able to "tough it out" and pass their annual PT test, there is no encouragement for members to maintain a good physical fitness

program all year long.

Surveys, like the aforementioned Air Command and Staff report on the effectiveness of the Air Force Fitness Program,47 show officer and NCO support for enhancing the program by toughening the standards, increasing the frequency of testing, and adding additional areas of development to address their individual wartime missions.

This desire for an improved physical fitness program has led several Major Air Commands to develop their own. Headquarters Military Airlift Command (MAC) has a program called "Fit Eagle". This program specifically focuses on fitness, proper diet, stress management, and smoking cessation. By improving the health and well being of their people, MAC is ultimately enhancing the quality of life for them and improving the overall mission readiness of the command. CinCMAC has emphasized wellness and physical fitness programs, and requires monthly reports be sent to HQ MAC outlining each individual wings efforts.

Another Major Air Command emphasisizing physical fitness is the Strategic Air Command (SAC). CINCSAC has directed that every military member in SAC will receive three hours a week, during duty hours, to participate in a structured physical fitness program. This is followed by a monthly three mile run lead by the unit commander! CINCSAC also requires feedback to advise him of the wings improvements.

Today, both the Army and Marine Corps have begun allowing units to develop specialized, unit unique training programs. These unit unique training programs not only improve individual physical conditioning, they also improve the units combat readiness through a physical conditioning program developed to address their wartime skills. Take, for example, the 75th Ranger Regiment based at Fort Lewis, Wa. They found their unique PT program contributed to their success in Operation Just Cause.[48] This Ranger unit feels their program is "battle-focused."

The 363 Civil Engineering Squadron (CES) at Shaw AFB, S.C. also developed an extensive physical fitness program. A program that emphasisizes their wartime mission. They call it the "Combat PT" program. For three years (1987-1990) the unit conducted this mandatory physical fitness program, on duty time, three days a week. In addition to aerobic fitness activities, the unit concentrated on developing upper body strength and endurance required for their wartime mission. Did this effort work? Extremely well! Not only did their completion times for preparing the AM-2 mat improve, but their stamina and endurance did as well. This is documented in the Hq TAC 1990 Operational Readiness Inspection (ORI) of the 363 Tactical Fighter Wing (TFW).

During the ORI, not one CES individual had to stop working, or had difficulty breathing while in their chemical warfare suit,

even in temperatures exceeding 80°F. However, the real test came during Operation Desert Shield. Individuals returning from the deployment, reported that the unit was able to constructed a tent city, housing over 3,000 personnel, in only six days. Furthermore, they reported that the "Combat PT" program really made the difference. Additionally, temperatures well in excess of 100°F did not significantly effect the completion of their mission. Furthermore, while many of the other "not-as-fit" individuals had to stay sheltered during the day, the 363 CES worked to provide everyone the basic water, latrine, and shower facilities. This unit was ready to go to war!

RECOMMENDATIONS

Clearly, the peacetime physical conditioning of the U.S. Air Force, as indicated by recent studies, merits increased attention. It is not unreasonable to expect military members to be as fit as untrained civilians even though an "average" level of conditioning will not adequately prepare them for the stress of war. Unfortunately, while many units engage in some kind of physical training, these activities are not part of an Air Force wide program. Everyone needs to be physically ready to go to war not just a few.

Physical fitness has always been linked to combat readiness, and the efforts to identify deficiencies in peacetime training

programs will increase our ability to sustain operations on the modern, high-intensity, battlefield. Clearly, there should be more attention paid to the units wartime mission. A good physical fitness program must balance aerobic conditioning with unit unique activities. Any improved program must be safe, effective, practical and medically sound. A strong, active aerobic conditioning program, following the general guidelines developed by Dr. Ken Cooper and other fitness experts, needs to be the core of a revitalized Air Force program. The exercise program utilizing the Monark 868 Cycle Ergometer has proven to effectively improve an individuals Vo2 max, the standard measure of fitness.

This would be best applied in conjuction with a mandatory physical fitness program, like the "Combat PT" program at Shaw, conducted three times a week. This program includes specific exercises and activities aimed at improving specific muscle groups required for the units wartime mission. This "Combat PT" approach to fitness needs to become an essential element of each units peacetime training.

Specifically, I recommend that the minimal standards for aerobic capacity should be established as condition for retention in the Air Force. All active duty personnel should have, at least, the Vo2 max of the average sedentary American. The program currently implemented for improving the cardiovascular endurance and physical strength of the Air Force firefighter

mandatory for all active duty personnel. Second, higher levels of fitness, more commensurate with the units wartime mission, should be obtained within a one year period and then maintained. Third, this new "Combat PT" program should be reviewed and supported by the Air Force Surgeon General. Further, it should be mandated by the Director of Engineering and Services, Hq USAF. Fourth, a comprehensive Air Force Pamphlet, titled "Combat PT" should be prepared to describe and to faciliate implementation of the new program.

A sound aerobic conditioning element as the "core" of a unit unique physical fitness program, mandatory three days a week, will quickly develop the Air Force as the leader in physical conditioning. Anything short would be unacceptable.

In the words of our Air Force Chief of Staff...

" I feel that being a warrior is a special job. It has special benefits, privileges and rewards. But it also makes some very special demands on people who decide to take up the profession of arms. I do not understand how warriors who are not physically fit can be ready for combat. So I try to maintain a certain standard of physical fitness. I urge everyone to do the same. We are not civilians in uniform. We are warriors. We need to act, feel, and be WARRIORS."

--- General Merrill A."Tony" McPeak
USAF Chief of Staff

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