HITT

HIGH INTENSITY TACTICAL TRAINING

METHODOLOGY

INTRODUCTION

The High Intensity Tactical Training (HITT) program is a comprehensive combat-specific strength and conditioning program that is essential to a Marine's physical development, combat readiness and resiliency. Different components of performance enhancement training are key components to superior speed, power, strength endurance and overall combat readiness while reducing the likelihood of injury and ensuring that our Marines are physically prepared for real-time combat / tactical situations while in theatre.

To fully understand the methodology behind the HITT program, defining the term "**functional**" based training as it relates to the tactical athlete is important to understand. Functional based training is a correctly designed program where the repetitive performance of movement patterns improves an individual's performance of job specific combat readiness and will attempt to balance physical capacities, strength, power, speed, agility and endurance while reducing the likelihood of injuries and over training syndromes.

To summarize, the benefits of such training - if applied correctly - will be twofold:

- An improvement in job specific combat readiness and overall physical performance
- Reduced injury rates, which can lead to an increased operational longevity of the tactical athlete

A sound strength program needs to focus on appropriate strength, power, elasticity, agility, and speed. The HITT Program will be based on 3 principles of a sound strength and conditioning program:

1. PREVENT POTENTIAL FOR INJURY

Preventing injuries from occurring while increasing the recovery rate from unavoidable injuries is the principle focus of the HITT Program. A well designed, balanced, and progressive program will prevent and eliminate muscle imbalances, strengthen tendons and ligaments, along with increasing maximal muscular strength and endurance. This result will without a doubt result in fewer injuries. A sound program will also address flexibility issues, as well as proper nutritional strategies that will also aid in recovery, regeneration, and injury prevention.

2. INCREASE PERFORMANCE THAT ACTUALLY TRANSFERS TO COMBAT

When training for improved performance the main goal is to improve performance where it counts most…in combat. A sound strength and conditioning program shouldn't include the things you like to do, or the things that you're good at. It should be designed around focusing on a comprehensive approach to balance all facets of performance enhancement, and exercises that will transfer your gains into combat.

3. BUILD STRENGTH, DEVELOP POWERFUL ELASTICITY, AND INCREASE SPEED

The stronger and faster a Marine is the more force they can produce. Powerful elasticity is another factor that will aid in improving performance. While having a great amount of power and strength is important, it is just as much important to be elastic as well. Sport specific speed is basically a combination of change of direction speed and linear speed.

RESILIENCY DEVELOPMENT CYCLE (PERIODIZATION)

To promote long term training improvements and avoid over training, The HITT program is periodized and split into specific phases, each with their own objectives and set of training parameters.

The overall training program (taken in a yearly snapshot as an example) is split into set phases and consists of the:

- Pre-Deployment Period
- Deployment Period
- Post-Deployment Period

By coordinating the different elements of the HITT training program with the phases of the above periods, the Marine can fully develop and maintain their physical readiness and resiliency.

Just as a year for an athlete is split into distinct phases so is the development of combat-specific strength and conditioning for the warrior-athlete. As mentioned later in this methodology, it makes sense to develop certain levels of performance enhancement before others. Here are the phases of a resiliency development cycle, in order, of the HITT strength and conditioning program and how they should coincide with the phases above:

PHASE 1 - REINTEGRATE

Deployment can have an unbalancing effect on the body's musculoskeletal system. One side of the body may become stronger than the other, agonists may be overly strong compared to antagonists and smaller muscle groups are often neglected. Left unchecked these imbalances can compound and may lead to chronic and acute injury.

Following a return from deployment, a break from structured training and the rigors of combat is crucial for physical and mental respite. This can mean a complete break from all types of strength training programs for several weeks. Any longer than 3-4 weeks however, fitness levels, particularly strength and power, diminishes rapidly. The active recovery phase occurs in the first 3 weeks of the post-deployment period.

A period of reintegration of foundational strength training (Athlete HITT) should occur around the third week of the post-deployment period following the active recovery phase. For Marines who are less experienced in strength and power development, it may be necessary to continue this phase during the early pre-deployment period.

PHASE 2 - STRENGTHEN

As Marines will benefit from a period of maximal strength training, overall strength must be converted into both combat-specific power and muscular endurance. Maximal strength is defined as the greatest force that is possible in a single maximum contraction. Muscular endurance is the ability of a muscle or group of muscles to sustain repeated contractions against a resistance for an extended period of time.

The maximal strength training phase usually occurs early the pre-deployment period (utilizes all 3 workout types of the HITT program). The conversion of maximal strength to muscular endurance occurs midway through the pre-deployment period and will peak the Marine as it relates to combat readiness prior to deployment.

PHASE 3 - MITIGATE

When strength training stops the benefits gained previously quickly diminish. In order to avoid this detraining effect during deployment a certain level of conditioning is required to maintain the gains made in the pre-deployment period.

Fortunately, the volume required to maintain strength is less than that required to build it. With a greater emphasis on tactical and skill-based training the maintenance phase occurs throughout the deployment period (Combat HITT).

Below is an example of how the various phases of HITT will occur in an annual program:

Performance Enhancement Phases for a Marine		
PHASE 1	**PHASE 2**	**PHASE 3**
Pre-Deployment	Deployment	Post-Deployment
Strengthen	Mitigate	Reintegrate/ Strengthen
Combat HITT Warrior HITT Athlete HITT	Combat HITT	Athlete HITT Warrior HITT

There are 5 unified components of functional based combat performance enhancement within the HITT program:

1. **INJURY PREVENTION**
2. **STRENGTH AND POWER**
3. **SPEED, AGILITY AND ENDURANCE**
4. **FLEXIBILITY AND CORE STABILITY**
5. **"FUELED TO FIGHT" NUTRITION**

INJURY PREVENTION

BENEFITS OF AN ACTIVE DYNAMIC WARM-UP

The warm-up is the first component to any sound program. Based on scientific research, the warm-up is designed to increase body temperature, increase blood flow to working muscles, activate muscle groups, stimulate the nervous system, and increase joint mobility. Performing the warm-up correctly prepares the athlete for success while decreasing the potential for injury when moving to the next component of the training session.

THERMOREGULATION

The physiological responses elicited by warm-up activity not only prepare the body for movement, but also carry out significant functions in enhancing the athletic performance to follow. One response to warm-up is the elevation of core body temperature. This rise in temperature should be exhibited by a mild perspiration. Elevated core body temperature lowers the tissue viscosity of the muscles, tendons, and ligaments. A lower viscosity, or resistance, in these particular tissues facilitates an increased range of motion. From a performance aspect, an increased range of motion in the muscles, tendons, and ligaments allows for improvements in movement mechanics as well as force production. In addition to core body temperature, the temperature of working muscles also increases as a response to warm-up. Compared to muscles at homeostatic temperatures, a warm muscle contracts with more force and relaxes in a shorter amount of time. The ability of muscles to contract more forcefully and relax more quickly enhances both strength and speed during training. Another goal of warm-up is to increase oxygen delivery to working muscles via increased blood flow. The two primary metabolic and chemical mechanisms that increase blood flow to the muscles are an increase in heart rate and vasodilatation. Upon the onset of warm-up activity, the heart receives signals from the nervous system stimulating a faster and more forceful pumping action. This mechanism is complemented by a dilation of blood vessels. When muscles begin to work, they emit metabolic byproducts at the cellular level. These byproducts then react with the capillaries in the muscle and cause an expansion or dilation. With more blood flowing to working muscles there is more oxygen available to those muscles. This increase in blood flow and oxygen availability to muscles through warm-up enhances performance by increasing aerobic energy production for prolonged activity.

INJURY PREVENTION

While there are various intrinsic and extrinsic factors that contribute to sport related injury, a proper active dynamic warm up considerably reduces the chance of injury. As previously mentioned, warm-up activity can lower the viscosity of muscles, tendons, and ligaments resulting in an increased range of motion. This mechanism also plays a significant role in injury prevention. As the viscosity is lowered and the range of motion increased, athletes also experience a decrease in muscle and joint stiffness. This creates an internal environment that assists in reducing the likelihood of non-contact injuries caused by the stresses of sudden and unexpected movements.

ACTIVE DYNAMIC WARM-UP COMPONENTS

The Active Dynamic Warm-Up consists of multi-joint, multi-muscle movements that are functional, similar to mission specific movements, and extend the dynamic range of motion of joints. Beyond the physiological responses, the dynamic warm-up also prepares flexibility necessary to perform combat skills, requires balance and coordination, and increases concentration levels. Furthermore, the dynamic warm-up addresses the differences of movement expressions seen when comparing dynamic versus static ranges of motion. The

Active Dynamic Warm-Up in the HITT program shall employ activities from four categories designed to encompass the goals and purpose of a pre-activity warm up while emphasizing movement preparation. The four categories are:

GENERAL MOBILITY

Activities used to increase blood flow, take joints through ranges of motion, and prepare the body for movement generally executed at a low exertion level in the start of the active dynamic warm-up.

MUSCLE ACTIVATION

Isolated movements used to stimulate specific muscles. The targeted muscles are those important to posture, stability, and force application during speed and agility training. Generally performed after core body temperature is elevated, these movements are also interspersed throughout the Transit and Dynamic Mobility movements.

TRANSIT MOBILITY

An activity that takes joints through a specific range of motion while traveling over a prescribed distance. These movements are designed to reinforce athletic movement, increase dynamic flexibility, while also increasing the intensity of physical exertion.

DYNAMIC MOBILITY

An activity that takes joints through an explosive or rapid range of motion. While similar to Transit Mobility, activities in this category generally do not travel over a distance and offer a final increase in intensity of physical exertion. These are often placed in advanced warm ups for athletes who have a higher level of skill and overall athletic development.

ACTIVE DYNAMIC WARM-UP TEMPO

A proper warm-up utilizes movements that progress from simple to complex. As a warm-up becomes more physically and mentally demanding, the muscular and neuromuscular systems are provided the opportunity to gradually reach training intensity without under-working or over-fatiguing the warrior-athlete. When a warm-up contains challenging and novel movements, the neuromuscular system is activated and progressively reaches a peak arousal level at the onset of training or competition. As arousal and neuromuscular levels are heightened, responsiveness is improved and reaction time is decreased. Athletic development is further enhanced by warm-up when the movements being utilized duplicate or are similar to those learned or practiced in prior training sessions. In this scenario, valuable motor skills are rehearsed while serving as a warm-up. Utilizing functional movements to elicit physiological mechanisms increases the rate of skill acquisition and accelerates the evolution of the Marine's movement training.

STRENGTH AND POWER 

A properly periodized strength and power training program is the most effective approach to strength training for a Marine. Not only will it help in the prevention of over training, it gives the Marine the best chance of peaking physically at the right time….deployment.

EXERCISE SELECTION

The principle of specificity states that training should mirror the demands of the combat specific movements as closely as possible. This applies not only to the way the body's energy systems and neuromuscular system is taxed (through manipulation of intensity and rest intervals, etc) but also to the movement patterns of each exercise.

Marines must divide their time and energy amongst various types of training - endurance, strength and power, speed and agility, tactical (MCMAP), water survival training, etc., and find the time to recover! By choosing only the most appropriate resistance exercises, volume can be kept to a minimum saving energy for other types of training.

DIFFERENT PHASES OF STRENGTH TRAINING

Unlike bodybuilding, where the only aim is to increase the size and appearance of muscles, the HITT strength and power component ultimately must develop both explosive power and muscular endurance while improving or maintaining flexibility throughout the musculoskeletal system. However, rather than immediately embarking on improving either or both of these fitness components, a more effective approach is to first build a solid foundation. There are 4 phases of strength and power training that will be incorporated in the HITT program:

FOUNDATIONAL STRENGTH

A Foundational strength training phase will adapt the body for more strenuous resistance training later on. The objective is to prepare the body by targeting all of the major muscle groups, tendons, ligaments and joints helping to prevent injury.

The less experienced in strength training a Marine is, the more time they will need to spend developing foundational strength before progressing onto more advanced forms of resistance training (Olympic Lifts, Plyometrics, Ballistics, etc.). Even experienced Marines should set aside some time during the year to complete a phase of foundational strength training. This phase will typically occur during the post-deployment period. It can help to redress some of the muscle imbalances that inherently occur during deployment.

MAXIMAL STRENGTH

A Maximal strength training phase will lead to neuromuscular adaptations that are favorable to Marines. This phase is administered post-foundational strength phase and will adapt the Marine to increase gains in strength to prepare him/her for the Explosive Power phase of the HITT program. The maximal strength training phase will also elicit gains in endurance activities.

EXPLOSIVE POWER

After a period of maximal strength has been developed, the third phase of the HITT strength training program is the explosive power phase. Most combat specific movements occur much more rapidly and demand significantly more power than lifting maximal loads. If maximal strength is not converted into combat-specific power, athletic performance will not improve - certainly not to the extent that it could. This phase focuses on "combat specific training" and is most specific to the daily rigors and movements while in combat.

MUSCULAR ENDURANCE

While many combat movements are dominated by powerful, explosive actions, Marines are also required to overcome a relatively low resistance but for a prolonged period of time. Muscular endurance will aim to convert maximal strength into muscular endurance.

The combat Marine requires a combination of the two – explosive power and strength endurance - and developing both simultaneously without one negating the other requires careful consideration.

DIFFERENT TYPES OF STRENGTH TRAINING

Strength training alone can increase explosive power by positively affecting the top half of the power equation or the **peak** force production diagram (later in this methodology). Most combat specific movements also start from a stationary position and it is this early phase of moving a resistance (be it a medicine ball or bodyweight) that requires the most effort. Therefore the greater an athlete's strength is, the more explosive this initial phase of motion will be. However, once this initial inertia has been overcome less force and more speed is required to continue the movement and heavy strength training becomes less suitable.

Additionally, lifting weights of 70-100% 1-RM has also been shown to reduce the **rate** of force production which is counter-productive to power development. This may explain why in strength trained individuals heavy resistance training is less effective at increasing vertical jump performance compared to ballistics or plyometrics for example.

For a Marine who already has a solid base of strength training (>6 months), gains in power occur at a slower rate related to untrained Marines who can significantly improve their power with weight training at a much faster rate due to the acclimation period (first 6 months).

Below are four components of strength and power training. A prerequisite to starting one of these routines is the development of a solid base of basic strength. Power development training, particularly Olympic Lifts, Plyometrics and Ballistics, becomes less effective and the risk of injury is increased if a phase of anatomical adaptation has not already been completed.

BASIC STRENGTH

Basic Strength is a weight training program designed to prioritize strength, rather than muscle size and definition (bodybuilding) or muscular endurance. Even so, a program such as this will build some muscle size and endurance because of the amount of work done. More importantly, this phase of strength training will prepare the Marine for the more demanding and challenging phases of strength and power development in the HITT program.

EXPLOSIVE POWER

A proper Olympic weightlifting (OL) routine shall be incorporated into the HITT program in order to elicit power and speed development enhancement.

It is imperative to understand that incorporation of OL in the HITT program is designed for individuals who have a significant strength base.

It is essential that younger and less experienced Marines follow an anatomical adaptation strength phase to prepare muscles, ligaments and connective tissue for more strenuous training such as this. Incorporation of an Olympic weightlifting routine is to be performed only after a Marine has recently completed at least 12 weeks of a foundational strength and conditioning program. Typically boot camp will accommodate the criteria for achieving a foundational period of strength training.

The two main lifts with proper progressions in Olympic weightlifting - the snatch and clean & jerk - are implemented in the HITT program.

Under correct instruction and supervision, OL is very safe and can offer Marines great performance benefits which include enhancing speed, improving flexibility, and reducing the likelihood of injury.

Olympic weightlifting routines, progressions and exercises play an integral role in the HITT program. While they will offer advantages to most Marines, they are only a single piece of the puzzle in the Combat Strength and Conditioning Program.

Olympic-style training in the HITT program is more combat-specific than a bodybuilding program design, however when training time is limited only the most relevant exercise selection will do.

For example, exercises such as power cleans work the hip extensors. Proper development of the hip extensors will help elicit speed development during speed and agility drills and ultimately transfer to proper movement during combat.

Even if one Olympic-style movement is combat-specific that doesn't mean they all are. A careful needs analysis should be the first step in the design of any strength and conditioning program.

Once a plateau in strength has been reached, more sport-specific types of power training are required. One of these training methods is a variation of traditional resistance training.

Completing traditional weight lifting exercises as fast as possible with relatively light loads produces in theory, the greatest power output. Unfortunately there is a problem with this approach...

Lifting a bar rapidly loaded with 30% 1-RM is difficult to execute, particularly in the final phase of the movement. The Marine must decelerate and stop the bar in order to keep it under control. This deceleration activates the antagonist muscles negatively affecting power output and hinders the required adaptations.

Ballistics and plyometrics avoid this problem, as there is no deceleration. The Marine is free to jump as high as possible or throw an object as far as possible without restricting the movement.

If free weights exercises are used for power training, loads of 75-85% is recommended for sets of 3-5 repetitions.

For single power efforts such as the grenade throw in the CFT, a higher load (80-90% 1-RM) can be used for a smaller number of repetitions (1-2). A multiple power effort movement such as the Maneuver Under Fire Drill in the CFT includes power, speed, agility, endurance and strength that requires repeated efforts.

Sets are **not** performed to exhaustion as the quality and speed of each lift is the most important factor. Rest intervals are also kept high for the same reason.

During a ballistic action, the force far outweighs the resistance so movement is of a high velocity. The resistance is accelerated and projected. Examples include a medicine ball throw and a jump squat. The aim is to reach peak acceleration at the moment of release projecting the object or body as far as possible.

While there is no definitive guidelines for the resistance used with ballistics, a load of 30-35% 1-RM should be used for exercises that include free weights such as jump squats. For many ballistic exercises the weight of the objects themselves dictate the load i.e. medicine balls ranging from 2-6kg (4.4-13lbs) and kettlebells ranging from 10-32kg (22-70lbs).

For exercises such as jump squats that use 30% 1-RM loads, up to 5 sets of 3 repetitions with 3 minutes rest between sets is recommended.

Ballistics can place considerable eccentric forces on joints, ligaments and tendons when landing from a jump squat for example. Marines should always progress gradually from unloaded to loaded exercises and must not be fatigued before starting a ballistic power training session.

Plyometric drills involve a quick, powerful movement using a pre-stretch or counter-movement that involves the **stretch shortening cycle**. Classical plyometric exercises include various types of jump training and upper body drills using medicine balls.

Plyometrics is a suitable form of power training for Marines. While many might see it simply as jumping up and down, there are important guidelines and program design protocols that need to be followed if plyometrics is to be as safe and effective as possible.

FUNCTIONAL STRENGTH

As defined before, functional based training is a correctly designed program where the repetitive performance of movement patterns improves an individual's performance of job specific combat readiness and will attempt to balance physical capacities, strength, speed and endurance while reducing the likelihood of injuries and over training syndromes.

Within the HITT program strength and power component, functional strength will play a critical role in the conversion phase of the program. Modalities such as suspension trainers, conditioning ropes, ammo cans and partner drills will be a focus in order to prepare the Marine for deployment.

CONSIDERATIONS IN THE STRENGTH AND POWER COMPONENT

PROPER COACHING

Compared to traditional weightlifting exercises, such as bench presses, squats and shoulder presses, Olympic lifts and associated lifts are complex movements. They require the co-contraction of several large muscle groups in the right sequence. Additionally, they must be performed quickly and with correct technique in order for the lift to be completed successfully. To that end, coaching from a qualified instructor is more important in the first phase than loading patterns and volume.

Before any amount of significant weight is added, athletes should practice Olympic-style lifts until coordination and technique is correct. However, it can be difficult to perform the lifts correctly with a light weight on the bar (< 30% 1-RM) due to difficulties controlling

deceleration of the bar at the end of the movement. Load should be increased gradually and sets should **not** be completed to failure.

LOADS, SETS AND REPETITIONS

As mentioned earlier, Marines not acclimated to Olympic lifts should use a light enough weight so that technique is correct. Progression in the early stages should be gradual and in small enough increments that the lifts can still be performed with correct technique.

Eventually, when the athlete can competently lift relatively heavy loads, target repetitions should be in the 3-5 per set range with loads of 75-85% 1-RM. Normally, with exercises such as bench presses and squats, loads in the region of 87-93% 1-RM can be lifted for 3-5 repetitions. **Peak Power** however, is achieved with moderate, not maximal loads, executed with a fast tempo. By using a load of 75% 1-RM (which would permit 10 repetitions with most traditional weight lifting exercises) and completing a maximum of 5 repetitions, proper form and speed of execution can be maintained.

About 3-5 sets of each Olympic-style lift is adequate and rest intervals should be long enough to promote almost complete recovery between sets. Recommended rest interval time is 2-5 minutes.

PEAK POWER DEVELOPMENT

Power training enables an athlete to apply the greatest amount of their maximal strength in the shortest period of time.

This is crucial for Marines who will rarely be required nor have the time to produce maximal forces.

Most combat specific movements involve faster and higher power outputs than are found in maximal strength exercises. A Marine can be exceptionally strong but lack significant explosive power if they are unable to apply their strength rapidly.

Various methods of power training, their parameters and how they can be used to convert maximal strength into combat-specific power is essential to proper performance.

It is important to have a basic understanding of the relationship between the **force** of movement and the **velocity** of movement...

The Force-Velocity Relationship

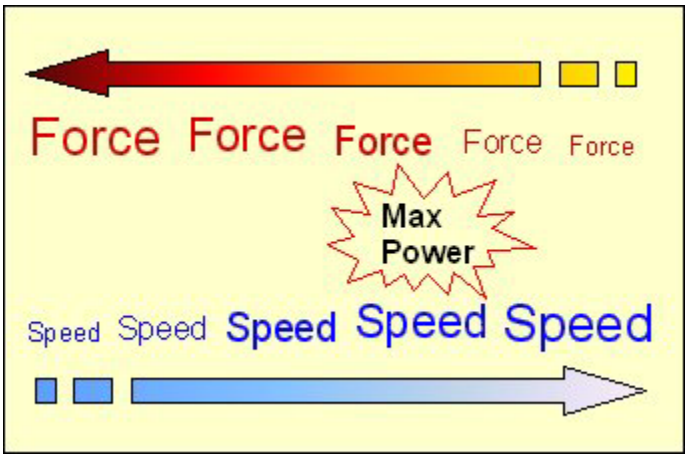
Power is intimately related to force and time, which can be expressed in the simple formula:

$$\text{Power} = \frac{\text{Force x Distance}}{\text{Time}}$$

Traditional strength training typically alters the top half of this equation - increasing the ability to apply a maximum amount of force. But for power to be maximized the time component must also be altered. This is the aim of the Olympic Lifting component in the HITT program - to reduce the amount of time it takes to apply a set amount of force.

Maximum force production occurs when the speed of movement is very low (i.e. performing a one repetition maximum lift) or zero such as performing a static or isometric exercise.

Conversely, as the speed of movement increases, force decreases and at very high speeds force production is very low. Between these two extremes is an optimal point for power development. In fact, **maximal power occurs at intermediate velocities when lifting moderate loads**. Peak power output is typically seen when loads of 30% one repetition maximum (1-RM) are used.



This relationship between force and velocity and its affect on power explains why a Marine can be exceptionally strong but lack significant power if they are unable to apply much of their strength over a short period of time.

Assuming a Marine has maximized his or her ability to apply force (through maximal strength training), it would be beneficial if they could train to increase the **rate of force production.** Increasing the rate at which strength can be generated positively alters the time aspect of the power equation above.

The goal of power training is to increase the rate of force production and there are several methods that have been devised to do this within the HITT program.

CONCLUSION

The type of strength and power training employed must be the most specific to the combat movements for a Marine. Incorporating a combination of Basic Strength, Functional Strength and Explosive Power exercises while emphasizing core development and injury prevention in the HITT program will play an integral role in the proper resiliency development cycle of the Marine.

SPEED, AGILITY AND ENDURANCE

From a hierarchical standpoint, the methods for developing speed and agility can be categorized as primary, secondary, or tertiary. This scheme is largely a matter of practicality and is based on a continuum of skills and abilities ranging from special to general. The key to applying these methods lies in their skillful combination rather than exclusive or disproportionate use of any one of them.

PRIMARY METHOD

The primary method for speed and agility development is execution of sound movement technique in a specific task. Initially, athletes should perform tasks at sub-maximal learning speeds to establish proper mechanics. As they progress toward mastery, task performance can approach or exceed full competition speed. For execution of specific techniques, an athlete's mechanics should target the performance criteria discussed in the previous sections

In contrast to some skills, running is a natural activity that most athletes have experience with-correct or otherwise. On the one hand, children usually learn the rough technique of running at an early age. To some extent, technique training can focus on perfecting form and correcting faults more than on teaching novel mechanics. On the other hand, many athletes acquire inefficient movement habits due to incorrect coaching or unfamiliarity with the advanced technique. This presents a challenge in terms of skill acquisition because it involves revising established motor programs.

SECONDARY METHODS

Secondary methods of speed and agility training include sprint resistance and sprint assistance. These target the development of special skills in modified performance conditions.

SPRINT RESISTANCE

This method includes gravity-resisted running (e.g., incline sprints) or other means of achieving an overload effect (e.g., harness, parachute, sled, or weighted vest). The objective is to provide resistance without arresting the athlete's movement mechanics, primarily as a means of improving explosive strength and stride length. In general, ≥10% changes in movement resistance have detrimental effects on technique (e.g., arresting the athlete's arm and leg actior in an attempt to muscle through each stride). Thus, strength and conditioning professionals should apply overload conservatively.

SPRINT ASSISTANCE

Sprint assistance includes gravity-assisted running (e.g., downgrade sprinting on a shallow [3-7°] slope), high-speed towing (e.g., harness and stretch cord), or other means of achieving an overspeed effect. The objective is to provide assistance without significantly altering the athlete's movement mechanics, primarily as a means of improving stride rate. Regardless of whether the athlete actually achieves overspeed, this method may also improve quality of effort during normal maximum-velocity sprinting by reducing the time and energy needed to accelerate. In general, apply assistance conservatively, exceeding maximum velocity by ≤10% (~1 m/s). Beyond this threshold, the athlete may tend to lean back and overstride in an attempt to brake and protect him- or herself.

TERTIARY METHODS

Tertiary methods of speed and agility training include mobility, strength, and endurance training. These target the development of general skills and abilities.

MOBILITY

It is important to view functional flexibility in the context of the optimal ROMs needed to perform specific tasks. During running, the hip and knee joints move through relatively larger ROMs than the ankle, which acts almost isometrically during the support phase by virtue of reflex stiffness and SSC action. The ability to fully retract the leg during recovery is requisite to achieving proper ground preparation position and subsequent ground strike. Inadequate mobility can therefore result in improper foot placement (e.g., overstriding), with longer ground contact times and higher braking forces.

If an athlete has sufficient mobility, the forces occurring within normal ROMs-rather than his or her flexibility-may determine performance or predisposition to injury. Therefore, it is simplistic to apply the notion of full range of motion to all tasks or joint actions.

Athletes can develop mobility restrictions because of imbalanced training or adaptive shortening for example, due to inactivity or immobilization. Strength and conditioning professionals should identify such limitations and specifically address them in training. Regular flexibility training generally seems to have beneficial effects on athletic performance and equivocal effects in terms of injury prevention. Given the task-specific functions of multiarticular muscles, it is important to assess flexibility with valid means and to use discretion when generalizing isolated joint actions to multijoint tasks.

STRENGTH

Athletes must develop explosive strength qualities in order to maximize their speed and agility performance. This does not imply, however, that they should perform only low-resistance, high-speed movements in training. The ability to achieve high movement velocities requires skillful force application across a range of power outputs and muscle actions. For maximal transfer to athleticism, resistance training programs should progressively address the entire force-velocity spectrum. This is achievable with mixed methods training strategies.

Strength and conditioning professionals should select and prioritize strength training tasks according to their dynamic correspondence with the target activity. Rate and time of peak force production and dynamics of effort are especially important criteria. Other considerations include amplitude and direction of movement, accentuated region of force application, and regime of muscular work. The keys to optimal transfer are threefold: identify the target activity's mechanics via task-specific needs analysis, choose training movements accordingly, and distinguish between specificity and simulation of a task's outward appearance.

Stretch-shortening cycle actions fulfill most or all of these criteria and usually deserve high priority in speed and agility training. The following is a simple classification scheme for plyometric tasks associated with SSC actions:

- Long response-ground contact >0.25 second, large angular displacement
- Short response-ground contact <0.25 second, small angular displacement

This scheme is useful in selecting tasks to improve specific running mechanics. For example, long-response plyometrics such as countermovement or squat jumps transfer most directly to start and acceleration performance, whereas short-response plyometrics such as depth or drop jumps have more transfer to maximum-velocity running.

Further, athletic movements like running and jumping involve force transmission and summation through the kinetic chain, rather than isolation within body segments. For example,

since the primary propulsive forces occur during ground contact, closed chain movements of the lower limb would be a logical starting point in selecting exercises to improve sprinting performance. The strength and conditioning professional might assign open chain exercises to a secondary, but still important, role. Indeed, braking the forward swing of the recovery leg in preparation for ground strike beneath the body is an open chain movement that athletes must execute properly in order to efficiently apply GRFs during the support phase.

SPEED-ENDURANCE

The objective of the speed-endurance method of training is to develop an athlete's special endurance-the specific metabolic conditioning needed to perform his or her movement skills in combat. The underlying strategy is to develop the ability to achieve a predetermined effort distribution, or a target pace or series of target paces, in training and competition.

The tactical metabolic training concept offers certain advantages. It economizes training time and effort by optimizing athletes' arousal, attention, and motivation through sport skill-based metabolic conditioning drills-for example, performing a series of exercises and drills in combat-specific workloads.

It is equally important to understand the limitations of this method. Unless accompanied by telemetry data, tactical modeling does not provide a direct measure of workload intensity. The strength and conditioning professional must therefore establish target training pace(s) for the observed interval duration(s). For activities in which resistance is limited to the athlete's body mass, one can estimate this by reversing an established method of projecting running time as a function of distance that is, projecting running distance as a function of time, and then making empirical adjustments according to an athlete's developmental status and workload tolerance. The energy cost can be estimated as a function of movement velocity for a variety of locomotion modes, thereby establishing equivalent workloads for different modalities.

Another limitation of this procedure is that tactical models based on start-stoppage patterns may not account for the total volume of work performed in combat. In general, however, this method is a pragmatic way to model special endurance training tasks on the underlying tempo of combat.

DIFFERENT PHASES OF LINEAR SPEED DEVELOPMENT

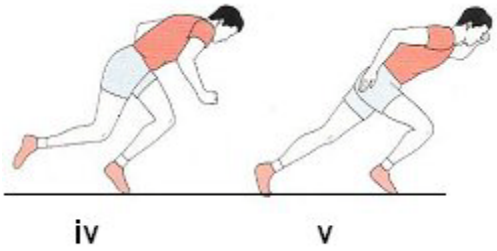
By breaking sprinting technique into its component parts you can focus on and improve specific phases of the action. Good sprinting technique has the following characteristics:

START PHASE

- Bodyweight evenly distributed over four contact points in the start position (i.e. hands and knees). Front knee angle is ~90^{o}, rear knee angle ~100-130^{o}.
- Explosive push off with both legs. Front leg extends remaining in contact with the ground while back leg swings forward. Extended front leg and trunk form a straight line.
- Arms swing opposite to legs, elbows flex to ~90^{o} and fists swing towards forehead.

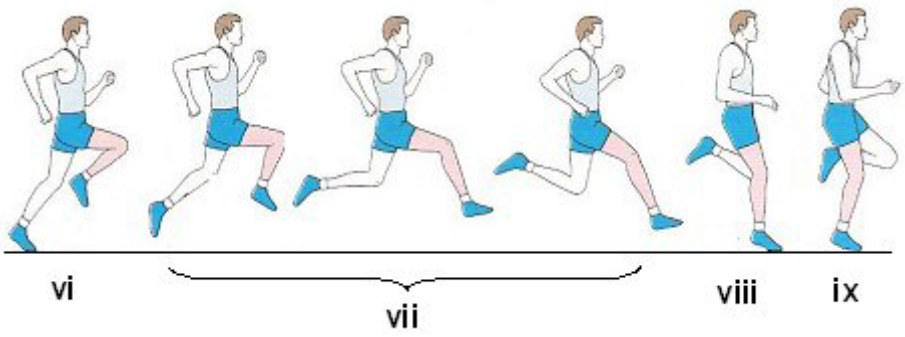
ACCLERATION PHASE

- After first two strides, foot touches down in front of center of gravity.
- Forward body lean begins to decrease until normal sprinting position is reached after about 22 yards (20 meters). Head is relaxed, eyes focused straight ahead.



MAXIMUM SPEED PHASE

- Push-off angle from ground is ~50-55^{o}. Trunk is almost erect with ~5^{o} forward lean.
- (Midflight) Push-off leg folds tightly towards buttocks in a relaxed heeling motion. Front leg thrusts forward and upward at maximum speed (~44mph in elite sprinters). When front thigh reaches maximum possible knee lift, lower leg swings forward in a relaxed movement.
- Foot meets ground with ankle slightly extended (plantar flexion) directly under center of gravity. Bodyweight is balanced so that only the ball of the foot touches the ground.
- Shoulders remain steady, elbows flexed at ~90^{o}, kept close to body throughout all phases. Hands swing forward and up above shoulder height, down and past hips.
- Arms and hands should have an aggressive hammering action. Head aligns naturally with trunk and shoulders and facial/neck muscles are relaxed by keeping the mouth slightly open.



BIOMECHANICS OF MAXIMUM SPEED

The HITT program will follow two of the following principals of Modern Running Technique:

- **Dorsiflexion** - big toe as close to shin as possible. The foot should recover this position as quickly as possible , recover in that position (so that it makes the leg a shorter lever) and in the downswing stay dorsiflexed . Many athletes lose their dorsiflexion before impact , losing their pre-stretch (losing power) , this increases contact time and allows them to contact the ground early. Every time an athlete hits the ground the first part of contact involves losing momentum. This can be minimized by maintaining dorsiflexion and having a fast moving backward (active) foot.

- **Early recovery** - athletes should minimize letting their hips tilt backward after impact. This will be evident as a less butt out running posture. Doing this will have two benefits it will allow the athletes hips to be more free to lift their knees easier and will allow less backswing of the upper leg. A large backswing/recovery is much slower and puts load on the hamstring that acts to help this sort of big recovery. It is much better to recover early under the body. Athletes that do this will not have the soles of their shoes face the sky or have vertical thighs as their foot comes close to their butt. Their thigh will already be forward as the foot comes close to the butt. (Marion Jones and Maurice Greene show this action).

CORE STABILITY AND FLEXIBILITY 

Flexibility is an aspect of athleticism that is trained during every session regardless of the movement, strength, or power focus. Defined as the range of motion (ROM) of a joint or series of joints, flexibility is universally accepted by those involved in athletics as a prime determinate of optimal sports performance. Understanding the nature and mechanisms of flexibility, along with proper training of this often-neglected component, enhances a performance coach's ability to effectively implement stretching exercises.

FACTORS AFFECTING FLEXIBILITY

The level of flexibility one can exhibit is determined by multiple factors. Some of these factors are constants and cannot be altered, while others have the potential to be influenced by proper training methods. While unchangeable factors should be taken into consideration, the focus of flexibility training is targeted at the factors that can be changed.

UNCHANGEABLE FACTORS

JOINT STRUCTURE

This anatomical factor determines potential ROM. For example, the shoulder joint (ball-and-socket) yields a greater ROM than the wrist joint (ellipsoidal).

AGE AND GENDER

In general, young people demonstrate more flexibility than older people do. This discrepancy is partly due to the process of fibrosis. As a person becomes older and less active, muscle fibers are replaced by a less elastic fibrous connective tissue. Gender differences are often exhibited with females possessing more flexibility than males. In young populations, this may be due in part to anatomical differences and the types of activities typically performed.

CHANGEABLE FACTORS

MUSCLE FIBERS

The elastic nature of muscle fiber allows itself to be stretched followed by a return to the normal position. This mechanism is much like that of a rubber band. While this specific characteristic cannot be drastically changed, another consideration regarding muscle fibers that can be changed is the size. A large increase in muscle density may negatively affect ROM. For instance, a person with large biceps and deltoids may have difficulty maintaining correct bar position during a front squat. Athletes and coaches should consider the benefits of muscle density versus the potential losses in ROM when designing an athletic performance program.

CONNECTIVE TISSUE

Tendons, ligaments, and fascial sheaths affect flexibility in that they present a limiting influence on ROM. In fact, the role of most connective tissue mechanisms is to protect the body from injury by preventing over-stretching particular joints. Although tendons are not meant to be stretched, ligaments and muscle fascia are able to adapt to slight stretching. Worth noting is that the most important target during flexibility training is connective tissue. When a relaxed muscle is stretched, most of the resistant to further lengthening is derived from the connective tissues around and throughout the muscle. The plastic nature of connective tissue allows increases in ROM to remain, even after the stretch is taken away. Thus, changes in connective tissue characteristics tend to be more permanent.

STRETCH REFLEX

In conjunction with connective tissue, the stretch reflex protects the body from quick and sudden movements that could potentially over-stretch and injure the muscle fibers. Discussed later in further detail, specific stretching methods can dampen this physiological mechanism, allowing for improvements in ROM.

ACTIVITY LEVEL

Given that an active person is apt to be more flexible than an inactive person is, this factor has the most potential of change.

STRETCHING METHODS

Mobility and flexibility is an integral component of the HITT Program. A properly designed mobility and flexibility training program increases ROM, breaks down scar tissue, and reduces the probability of injury caused by strains. In addition, a flexibility characteristic essential for athletes is the development and maintenance of mobility that is balanced proportionally throughout major muscle groups. Balanced levels of mobility and flexibility are necessary for specific and functional musculoskeletal ROM. Typically performed during the Active Dynamic Warm-Up and post-session cool down periods, mobility and flexibility training relies on three methods to develop balanced and functional ROM. Although these three stretching styles share the common goal of increasing ROM, each method has a separate and crucial role in the development of overall flexibility. The following are descriptions of the mobility and flexibility methods which can be used and implemented at a variety of times (benefits of stretching are only achieved if there has been a prior elevation in core temperature).

STATIC STRETCHING

This common mode of stretching is performed by passively relaxing a particular muscle while holding a near-maximal stretch for an extended period. This stretch should only produce moderate tension. Preferred because this method allows for a greater stretch by avoiding quick lengthening of tendons and the resulting stretch reflex, static stretching also has potential drawbacks. Research has shown that static stretching may produce acute inhibition of strength and power performance. There seems to be a dulling effect in the muscle's ability to produce force after stretches are held for extended periods. Simply put, if an athlete executes a static stretching routine and then attempts a maximal vertical jump, chances are they would score below their normal or optimal performance. Due to this phenomenon, static stretching should be performed as a post-session cool down method. Performing this method at the end of a training session will avoid the potential drawbacks while still improving ROM and reducing soreness due to training.

DYNAMIC FLEXIBILITY

Dynamic stretching is the expression of ROM during movement, and may be the most athletic-based method of flexibility training. The exercises consist of multi-joint, multi-muscle movements that are functional and similar to sport movements while simultaneously extending the dynamic ROM of the joints. It is not uncommon for an athlete to actively exhibit a larger ROM at a particular joint when performing a sport skill, than a ROM that can be reached statically. In view of that, dynamic stretching addresses this difference in movement expression. Furthermore, dynamic flexibility training efficiently fits into any pre-activity warm-up while also contributing to overall athleticism due to the requirement of balance, coordination, and active movement.

ACTIVE ISOLATED STRETCHING (AIS)

This method of flexibility and fascial release utilizes active movement and natural physiological mechanisms to achieve optimal flexibility. These stretches utilize rope-like pieces and are performed by actively contracting the antagonist muscle, allowing the target

muscles to relax (reciprocal inhibition), then stretching and holding for approximately 2 seconds. The rope is used to assist in gently increasing the ROM further than can be held ordinarily. Performing an AIS exercise for 2 seconds allows the target muscle to optimally lengthen without triggering the protective stretch reflex, while the reciprocal inhibition mechanism allows the targeting of connective tissue. Performing AIS with 1-3 sets of 4-8 repetitions on each limb facilitates the development of full ROM and flexibility.

CORE STRENGTH AND STABILITY

Core stability describes the ability to control the position and movement of the central portion of the body. Core stability training targets the muscles deep within the abdomen which connect to the spine, pelvis and shoulders, which assist in the maintenance of good posture and provide the foundation for all arm and leg movements.

Implementation of Core strengthening exercises have shown to directly improve performance with regards to injury prevention. Using unstable surfaces, unilateral lifting, standing while lifting, and using free weights all help integrate the core into resistance programs. Greater core stability also may benefit performance by providing a foundation for greater force production in the extremities.

An increase in core stability can help maximize running performance and prevent injury. Power is derived from the trunk region of the body and a properly conditioned core helps to control that power, allowing for smoother, more efficient and better coordinated movement in the limbs. Moreover, well-conditioned core muscles help to reduce the risk of injury resulting from bad posture. The ability to maintain good posture while running helps to protect the spine and skeletal structure from extreme ranges of movement and from the excessive or abnormal forces acting on the body.

"FUELED TO FIGHT" NUTRITION 

It is well accepted by nutrition and fitness organizations that nutrition is a critical factor in enhancing athletic performance, injury prevention, recovery and resiliency in athletes and is transferable to active duty Marines. The appropriate selection of foods and fluids, proportions of macronutrients and timing of when ingested are important for maximum performance and give an edge to competition/combat. Proper nutrition provides adequate Calories, protein and many other nutrients necessary to support intense workouts and improve performance, while maintaining body weight and body composition.

"Fueled to Fight" is a healthy nutrition program that has been revised in coordination with I & L, Headquarters and the MCCS Semper Fit Registered Dietitians for USMC Chow Halls/Mess Halls as part of a larger DoN initiative. It is a program that uses a color coding system (red/yellow/green light concept) for proper food identification. The goal of this program is to provide identifiable healthy choices and to educate Marines on healthy eating habits that can be applied not only on base but, "outside the base gates."

ENERGY/CALORIES

Marines need to consume adequate Calories to support high-intensity or long-duration training. This is often overlooked as there seems to be a priority placed on protein consumption rather than overall Calories. Inadequate Calories can result in loss of muscle mass, loss of bone density and an increased risk of fatigue, illness, injuries and poor recovery.

PROTEIN

Dietary protein is required to promote growth, repair damaged cells and tissue, synthesize hormones, and for a variety of metabolic activities. While sedentary and active people use protein the same way, Marines may need higher amounts due to increased protein synthesis post exercise. Recommended protein intakes for Marines and athletes can be met through diet alone without the use of protein supplements. It is generally recommended that protein intakes fall within 1.2 – 1.7 gm/kg (0.5 – 0.8 gm/lb) bodyweight for Marines and athletes depending on type and amount of physical activity. Higher amounts of protein show no additional benefit in numerous studies.

CARBOHYDRATES

Carbohydrates are the main body's source of energy. Carbohydrates maintain blood glucose during exercise and replaces muscle glycogen after exercise. Choosing high quality carbohydrates (fruits, vegetables, beans, brown rice, whole wheat breads, pasta and other grains), and limiting refined, processed carbohydrates (white bread, white rice, cookies, cakes, chips and other "junk" food) gives the body the best fuel while maintaining blood glucose levels. Besides water, carbohydrates are the most limiting factor of physical performance and the amount and timing of carbohydrate ingestion is imperative for best functioning. It is generally recommended that carbohydrates fall within 6 – 10 gm/kg (2.7 – 4.5 gm/lb) depending on type and amount of physical activity.

FAT

Fat is a source of energy, provides essential fatty acids, carries fat soluble vitamins and is an important nutrient for Marines. The focus should be placed on including monounsaturated fats (olive oil, canola oil, nuts and seeds, natural peanut butter, avocado and fatty fish like salmon) while limiting saturated fats (butter, high fat red meat, fried foods, hydrogenated and trans fats, desserts, cheese and other whole fat dairy) in the diet. It is generally recommended that fat intake fall between 20 – 35% of total energy intake.

NUTRITION PERIODIZATION

Nutrition Phases for a Marine		
PHASE 1	**PHASE 2**	**PHASE 3**
Pre-Deployment	Deployment	Post-Deployment
Strengthen	Mitigate	Reintegrate/ Strengthen
Carbohydrate: **8-10 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 8 x 82 = 656 gm carbs/day (2624 calories from carbs/day) 10 x 82 = 820 gm carbs/day (3280 calories from carbs /day) **Protein:** **1.5-1.7 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 1.5 x 82 = 123 gm pro/day (492 calories from protein/day) 1.7*82 = 139 gm pro/day (558 calories from protein/day) **Fat:** **1.0-1.5 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 1.0 x 82 = 82 gm fat/day (738 calories from fat/day) 1.5 x 82 = 123 gm fat/day (1107 calories from fat/day) ***Calorie range for 180 lbs.-*** ***3854 kcals/day up to*** ***4945 kcals/day*** ***Calorie range for 120 lbs.-*** ***2562 kcals/day up to*** ***3287 kcals/day***	**Carbohydrate:** **6-8 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 6 x 82 = 492 gm carbs/day (1968 calories from carbs/day) 8 x 82 = 656 gm carbs/day (2624 calories from carbs /day) **Protein:** **1.2-1.4 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 1.2 x 82 = 98 gm pro/day (392 calories from protein/day) 1.4 x 82 = 115 gm pro/day (459 calories from protein/day) **Fat:** **1.0-1.5 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 1.0 x 82 = 82 gm fat/day (738 calories from fat/day) 1.5 x 82 = 123 gm fat/day (1107 calories from fat/day) ***Calorie range for 180 lbs-*** ***3098 kcals/day up to*** ***4190 kcals/day*** ***Calorie range for 120 lbs.-*** ***2061 kcals/day up to*** ***2785 kcals/day***	**Carbohydrate:** **6-7 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 6 x 82 = 492 gm carbs/day (1968 calories from carbs/day) 7 x 82 = 574 gm carbs/day (2296 calories from carbs /day) **Protein:** **1.4-1.6 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 1.4 x 82 = 115 gm pro/day (459 calories from protein/day) 1.6 x 82 = 131 gm pro/day (525 calories from protein/day) **Fat:** **1.0-1.2 gm/kg BW per day** Ex. 180 lbs. ÷ 2.2 = 82 kg 1.0 x 82 = 82 gm fat/day (738 calories from fat/day) 1.2 x 82 = 98 gm fat/day (885.6 calories from fat/day) ***Calorie range for 180 lbs. -*** ***3165 kcals/day up to*** ***3707 kcals/day*** ***Calorie range for 120 lbs.-*** ***2104 kcals/day up to*** ***2464 kcals/day***

**Nutrition recommendations based on weight maintenance and muscle gain needs, not for weight loss.*

Nutrition Periodization refers to a nutrition plan developed to match an athlete's training program, similar to a periodized fitness training plan. The nutrition protocol for "Fueled to Fight" follows the same periodization phases as the HITT physical training protocol (Pre-Deployment, Deployment and Post-Deployment Period). The recommendations for Protein, Carbohydrate and Fat are presented as a range and should reflect training intensity (the lower numbers for lower intensity and the higher numbers for higher intensity). These recommendations are based on weight maintenance and muscle growth; not weight loss. If weight loss is desired, modifications should be made through a Semper Fit Dietitian or Personal Trainer.

HYDRATION

Water and hydration levels are critical for maximum performance. Hydration is the most limiting factor involved with physical performance. Even small amounts of dehydration will hinder performance and can give the opponent an edge. Hydration plays a critical role in regulating body temperature, carrying nutrients throughout the body and eliminating waste and toxins. Just small amounts of dehydration can greatly affect performance. A 150 lb athlete with a water loss of just 3 lb can have reduced performance by 10 – 20% and his effort will feel harder than normal. With a water loss of just 4½ pounds reaction times, judgment, concentration and decision making ability are negatively affected. Temperature regulation and brain function are also impaired. It is recommended that Marines drink half their body weight (lb) in ounces of water at a minimum, not counting exercise. (Ex. 150 pounds/2 = 75 ounces water per day). Below are additional hydration recommendations for exercise.

Hydration for Exercise

Timing	How much Fluid?
2 hours before	**2 cups** (16 oz.)
20 minutes before	**1-1.5 cups** (8-12 oz.)
Every 15-20 minutes during	**.5-1.5 cups** (4-12 oz.)
After activity	**2 cups** (16 oz.)

**Tip: 1 avg. adult-size gulp = 1 oz. of fluid.*

ATHLETE AND SPORTS NUTRITION GUIDANCE

HYDRATION – How much do you need every day?

- Your body weight in pounds divided by 2 = the minimum number of ounces of fluids you need per day (This does not include the amount of exercise you do or the climate you are in.)

Example: 120 pounds ÷ 2 = 60 ounces of water per day

Half Gallon = 64 ounces 1 Gallon = 128 ounces 1 Canteen = 32 ounces

*** For most people, 1 large gulp = 1 ounce**

With exercise add:

- 16 ounces (1/2 canteen) - 2 hours prior to exercise
- 4-8 ounces* - 10 minutes prior to exercise
- 4-8 ounces* - every 20 minutes during
- 16-24 ounces after exercise
-

For exercise lasting longer than 60 minutes

- Use sports drinks for hydration, glucose and electrolytes to improve endurance performance (Powerade, Gatorade)
- Per 8 ounces: 12-24 grams of Carbohydrate; 110-170 mg of Sodium; 20-50 mg Potassium

Symptoms of dehydration:	**For these symptoms, notify your instructor immediately**:
• Thirsty • Headache • Dry Mouth • Dry Skin • Fatigue • Dizzy	• Chills • Increased Heart Rate • Muscle Cramps • Nausea/vomiting • Swollen stomach • Confusion

PROPER FUELING

What to eat-

- 55-65% from Carbohydrates to fuel muscles and brain
  - Eat **Whole Grain and Whole Wheat Breads** (1st ingredient needs to be "whole grain flour" or "whole wheat flour"), **Whole Grain Cereals** (Kashi, Oatmeal, Fiber One, Wheaties), **Brown Rice, Whole Wheat Pasta**, **Fruits, Vegetables, Beans and Legumes** (pinto, black, lentils, split peas, kidney), **Low-fat Dairy**
- 20-30% from Fat to absorb vitamins and cushion organs, tissues, and joints.
  - Eat **Healthy, Unsaturated Fats (olive oil, olives, nuts and seeds, natural peanut butter, avocado, fatty fish, flax seed)**
  - Limit Saturated Fats (fried, animal fats, hydrogenated foods and processed)
  - Avoid Trans Fats (hydrogenated foods and processed)
  - At least 75 grams of **total fat**/day
- 15-20% from Protein to build and repair muscle
  - Eat **Lean Meats** (poultry, fish, lean sirloin and pork tenderloin), **Eggs**, **Low-Fat Dairy** (milk and soy milk, cottage cheese, yogurt), **Nuts and seeds, Beans, and Legumes**
  - The best diet contains adequate but not excessive protein. Extra protein does not build extra muscle, exercise does - proper training builds and strengthens muscles.
  - Protein needs per pound of body weight:
    - Athlete 0.5 - 0.80 gm pro/lb
    - Athlete Building Muscle Mass 0.7 - 1.0 gm pro/lb
    - Athlete Restricting Calories (needs weight loss) 0.8 - 1.0 gm pro/lb

When to eat-

- A key to healthy eating is fueling your body throughout the day, eating every 3-4 hours is ideal.
- **BEFORE Exercise**
    - Eat a carbohydrate-rich meal with protein 3-4 hours prior to exercise
        - Examples: Banana and peanut butter sandwich and milk; Bagel sandwich w/ lean meat, cheese and veggies; Chicken, rice and veggies; Spaghetti with lean meat and a salad
    - Eat a carbohydrate-rich snack 30 minutes to 2 hours before training/competition.
        - The timing is wide because each individual's stomach is different- some people can eat right before they exercise and not get an upset stomach, others cannot.
        - Examples: a piece of fruit, ½ bagel, or a granola bar
- **AFTER Exercise**
    - Eat a combination of carbs and protein within 30 minutes of exercise.
        - Examples: 8-16 oz chocolate milk or flavored soy milk; Turkey sandwich; Flavored Greek yogurt and fresh fruit; Fruit and yogurt smoothie
    - Eat a balanced meal containing all the food groups (protein/dairy, grains, fruit, veggies) within 2 hours.
        - Examples: Homemade Burrito (tortilla, beans, lettuce, tomato, low-fat cheese, and salsa); Grilled poultry, brown rice, veggies, and fruit; Tuna salad made with veggies, whole grain crackers, provolone cheese, and fruit

All Marines need to focus on their nutritional fitness the same way they focus on their physical fitness.

ARE YOU FUELED TO FIGHT?

		Engage at Will (Great Choices)	Well Aimed Shots (Use Occasionally)	Check Fire (Limit)
Dairy	*3 cups every day	Non Fat or 1% Milk, Fat Free or Low Fat Yogurt or Greek yogurt, Non Fat Sour Cream, Cottage Cheese (non fat or 1%), Non fat Dry Milk	2% Milk, Sherbet/ Frozen Yogurt, Low Fat Sour Cream, Low fat & Light Cheese, Buttermilk, Ice Milk	Whole Milk, Creamer, Whipped Cream Whole Milk Yogurt, Sour Cream & Cottage Cheese, Regular Cheese & Ice Cream, Milkshake, Cheesecake
Meat/ Protein Sources	*5 to 7 ounces every day	Egg Whites, Egg Beaters, Any Fresh Fish, Chicken or Turkey breast (without the skin) Round cuts of beef, pork tenderloins, Non fried tofu or other soy products.	Whole Eggs, Fish: water- packed canned, salted or smoked, Shellfish Game Hen, Dark Poultry meat, Canned Chicken, Turkey Franks Most Beef, Pork, Lamb, Veal (extra lean)	Egg yolks, Fish: Oil packed canned, Fried Fish Processed Meats (sausage, bacon, hot dogs, some lunch meats) & Organ Meats Fried & Fast Foods Meat, Canned Meats & Stews, Fatty Marbled Red Meat
Grains/Cereals	*At least 6 to 8 ounces a day. AT LEAST ½ of the grain servings should be whole grains. Example: 1 slice of bread, 1 cup of ready-to-eat cereal, or ½ cup of cooked rice, cooked pasta, or cooked cereal can be considered as 1 ounce equivalent.	Whole wheat pita, tortilla, or English muffins, whole grain cereal or pasta, Whole cornmeal, Bulgur. Look for grains with 3 or more grams of dietary fiber per serving. Whole grain pretzels. Grain crackers, rice cakes, brown rice. Buckwheat, oatmeal, muesli, whole rye, wild rice, amaranth, millet, quinoa, sorghum. Popcorn: air popped, no butter.	Breads or cereals with less than 3 grams of fiber per serving. Refined grains and pastas such as corn tortillas, couscous, de-germed cornmeal, crackers, flour tortillas, white flour, white rice, regular pasta, grits, and noodles. Most pretzels. Pancakes, bagels or muffins with less than 3 grams of fiber per serving. Baked chips. Popcorn: low fat and light	Most snack crackers, most granola, biscuits, bakery products such as cake, pies, cookies, doughnuts, Danishes. Prepackaged rice or pasta with sauces. Macaroni and cheese. Sweetened cereal. French Fries. Chips. Popcorn: regular microwave or popcorn from the movies
Fats & Oils	Use Sparingly	Spray Oils (ex Pam) Use other spices, seasonings	Imitation/ Reduced Fat Mayo Salad/ Vegetable Oil Margarine, Low fat & light salad dressing	Regular Mayo, Tartar Sauce, Butter, Hard Margarine, Palm and Coconut Oil, Animal Shortening / Lard
Dried Beans, Peas, Nuts	Dry beans and peas can be counted either as vegetables (dry beans and peas subgroup), or in the meat, poultry, fish, dry beans, eggs, and nuts (meat and beans) group.	Natural peanut butter, almond butter, kidney beans, pinto beans, lima beans, black beans, chick peas, split peas, black-eyed peas, and lentils	Regular peanut butter, low fat refried beans, some varieties of garden burgers or veggie burgers. Texturized vegetable protein. Unsalted sunflower seeds, almonds, walnuts, and hazelnuts (filberts).	Refried beans, salted nuts, and some packaged trail mixes.
Fruits and Vegetables	At least 2.5 cups of fruit and at least 4 cups of vegetables a day Example: 1 cup of fruit or 1 cup of 100% fruit juice counts as 1 cup. ½ cup of dried fruit can be considered as 1 cup. Example: 1 cup of raw or cooked vegetables, or 1 cup of vegetable juice counts as 1 cup.	All fresh fruits and vegetables. Frozen vegetables.	100% fruit and vegetable juices. Frozen juice bars. Salsa. No added salt canned vegetables. Dried fruit. Unsweetened applesauce. Avocado, olives, sauerkraut	Canned fruit in light or heavy syrup. Regular canned vegetables. Sweetened applesauce. Frozen fruits with added sugar. Frozen veggies with sauce or cheese. Coleslaw, potato salad, French fries, onion rings, hash browns, tater tots, scalloped or Au Gratin Potatoes. Deep fried vegetables. Fruit candies, fruit drinks that are not 100% fruit juice, sweetened dried fruits.
Beverages	*Serving size depends on individual needs	Water, Non fat or 1% milk, Unsweetened Tea and Coffee	Sports Drinks, Diet Soda, 100% fruit and vegetable juices, 2% milk	Energy Drinks, Regular Soda, fruit drinks, punch, lemonade, sweet tea, whole milk, alcohol
Supplements	*Serving size depends on individual supplement	If your doctor has determined the supplement is safe for you and prescribes a safe dose to follow.	Multivitamin products with seals from third-party verification programs (Ex. USP, NSF, etc). Vitamins/minerals that do not exceed 100% of the daily value. Always ask a physician before taking a vitamin/mineral. Small doses of caffeine may increase athletic performance if approved by your physician.	Energy Drinks. Any supplement that has limited research. Any supplement that you have not cleared with a physician. Supplements may interact with medications and may cause increased risk for dehydration.

**Serving size is based on males and females aged 19 to 30 years old who engage in at least 30 minutes of physical activity most days of the week. Serving sizes vary depending on height/weight, age, gender, and level of physical activity.*

Helpful websites: www.humanperformanceresourcecenter.org; www.nal.usda.gov/fnic; www.nlm.nih.gov/medlineplus; http://champ.usuhs.mil/warfighterguide.html

For more information on nutrition or *Fueled to Fight*, contact Semper Fit

For maximum physical and mental performance, at every meal, eat carbohydrates, protein and drink milk.		
	Carbohydrates = Fruits & vegetables, low fat milk/yogurt/soy milk, whole grain bread, pasta, cereal, oatmeal, beans, peas, corn, potatoes. ***Choose 100% WHOLE GRAIN products.***	Protein = Low fat milk, yogurt, cottage cheese, & cheese, lean meats, eggs, fish & poultry, beans, nuts, and seeds, whole grains, soy products.

NUTRITION GUIDANCE FOR MALES AND FEMALES

Problem	What should you do?	Food Sources	Result
Low energy; sluggish; easily tired	Eat foods rich in CARBOHYDRATES	Whole wheat bread, cereal, pasta, rice, peas, corn, potatoes, fruits, veggies	Carbohydrates provide fuel for muscles and brain
Muscle strains, injuries; slow to recover	Eat good food sources of PROTEIN	Chicken, fish, beef, cheese, milk, nuts, seeds, peanut butter	Faster recovery from injury; repair muscles
Trouble sustaining energy output	Eat healthy FAT sources	Nuts, seeds, peanut butter, olive oil, olives, fish, canola oil, avocado	Greater energy output; build muscle more efficiently;
Constipation	Increase FIBER in diet	Whole grain bread & cereal; beans, peas, fruits and vegetables	Relief!
Difficult maintaining body temperature; low energy	Increase IRON rich food sources	Beef, chicken, turkey, fish, spinach, kale, beans, peas, fortified breads, cereal s and juice	Greater energy; better tolerance to cold
Broken bones; stress fractures; brittle teeth	Increase CALCIUM rich foods. Increase VITAMIN D food sources.	Milk, yogurt, cheese, salmon, broccoli, kale, calcium fortified foods. Vit D fortified milk, eggs, seafood, fortified cereals	Strengthen bones and teeth; Vitamin D helps body absorb calcium and thus helps prevent fractures and bone weakness.
* Increase muscle mass	Increase CALORIES and PROTEIN rich foods	Fish, chicken, lean beef, pork, milk, eggs, cheese yogurt, peanuts, nuts/seeds, beans, lentils	Protein intake must be combined with weight training to build muscle mass.

TESTING AND ASSESSMENT

ATHLETIC PERFORMANCE ASSESSMENT

An integral component of building overall athleticism is the evaluation process. These evaluations serve to create an athletic snapshot and provide a baseline of performance to measure individual improvement. Additionally, the comparison of periodic and sequential HITT Athletic Assessment values is the primary tool used to monitor the warrior athlete progress as well as effectiveness of the training program. Aside from testing values, performing evaluations also allows the combat strength and conditioning specialist to observe key movement patterns that may or may not be reflected in the results. The HITT Athletic Assessment is an important component of the HITT Program regimen.

There are 3 components of the Performance Assessment within the HITT program:

- Power
  - Standing Broad Jump
  - Kneeling Power Ball Throw
- Speed
  - Prone 25 Yard Dash
- Agility
  - Prone 5-10-5 Drill
  - Prone 3 Cone Drill
- Endurance
  - 30-15 Intermittent Fitness Test (IFT)
- Mobility
  - Functional Movement Screen (FMS)

Description of the components

HITT test selection for the United States Marine Corps is based on assessing overall athleticism and mobility. Due to the design of the training programs, the performance evaluation assesses overall abilities of athletic performance as it relates to specific combat movements.

- ***Standing Broad Jump:*** The standing broad jump test reveals an athlete's development of lower-body peak power, a performance characteristic proven to distinguish athletes of various ages and competitive classes. Many studies have shown that jumping ability, and thus peak lower body power, is a reliable predictor of acceleration and speed among various field-sport athletes. The Standing long jump, also called the Broad Jump, is a common and easy to administer test of explosive leg power. The broad jump is one of the best simple drills that you can use to develop lower-body power. It requires coordination and power through all the muscle groups of the lower body and develops the strength and explosiveness that are essential to both jumping and straight-ahead speed.

- **Kneeling Power Ball Throw:** As an integrated multi-joint movement, the Kneeling Power Ball Toss mimics the upper body pressing and pushing demands of athlete-on-athlete sports. This test serves to assess the athlete's ability to initiate power through the hips while further evaluating the strength and explosiveness of the upper body.

- ***Prone 25 Yard Dash:*** The 25 yard dash test measures an athlete's rate of acceleration and ability to transition into top speed running. The ability to exhibit both high rates of acceleration and top speed during theatre are critical to the movement patterns of the warrior athlete.

- ***Prone 5-10-5 Drill:*** This test assesses the agility of the warrior athlete. It measures the athlete's ability to maintain body control through rapid changes of speed and direction. Many combat specific movement situations demand multiple changes of direction which in turn require the strength to decelerate, alter posture and orientation then re-accelerate toward a target. This test, with two sharp changes of direction, simulates those challenges.
- ***Prone 3 Cone Drill:*** This test also assesses the agility of the warrior athlete. It measures the athlete's ability to maintain body control through rapid changes of speed and direction while maneuvering around objects and maintaining control.

- ***30-15 Intermittent Fitness Test:*** The 30-15 IFT is designed to elicit maximum heart rates and VO2, but additionally the anaerobic capacity, inter-effort recovery capacity, acceleration, deceleration, and change of direction abilities.

- ***Functional Movement Screen:*** The FMS is a ranking and grading system that documents movement patterns that are key to normal function. By screening these patterns, the FMS readily identifies functional limitations and asymmetries. These are issues that can reduce the effects of functional training and physical conditioning and distort body awareness. The FMS generates the Functional Movement Screen Score, which is used to target problems and track progress. This scoring system is directly linked to the most beneficial corrective exercises to restore mechanically sound movement patterns. Exercise professionals monitor the FMS score to track progress and to identify those exercises that will be most effective to restore proper movement and build strength in each individual.

CONCLUSION

The High Intensity Tactical Training (HITT) program's primary purpose is to enhance operational fitness levels and optimize combat readiness and resiliency for the active duty Marine. This comprehensive strength and conditioning program takes into consideration the physical demands of operational related activities in order to optimize physical performance while in combat. By implementing the latest cutting edge training methods and fundamental scientific principles, the HITT program focuses on enhancing athleticism for today's warrior athlete – The United States Marine.

"As the worldwide authority on strength and conditioning, The National Strength and Conditioning Association's (NSCA) TSAC (Tactical Strength and Conditioning) department supports that the HITT program methodology offers a comprehensive and balanced strength and conditioning approach specific for combat readiness and physical resiliency. The HITT program is aligned with the NSCA's national standards and guidelines and provides research-based knowledge/curriculum along with practical application to improve athletic performance specific to today's Warrior Athlete."

- NSCA-TSAC Department

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