Impulse HPV.5 Manual

Welcome to Impulse Inertial Exercise Training
The safest, most versatile exercise machine available.

General Conditioning
Anaerobic Cardiovascular Conditioning
Hypertrophy Development
Sports Specific Power Development
Functional Rehabilitation for Injury/Disability

Many thanks are due to all the coaches, trainers, therapists, and researchers who shared their knowledge, time and experience in the development of this important technology.
INTRODUCTION

Impulse Inertial Exercise was born in 1982 in Steve Davison’s basement where the first Inertial Exercise Machine was designed and built. He had come to the realization that the majority of human motion on earth was independent of gravity, dependent on horizontal acceleration, and restricted by one’s ability to control inertia. Yet, no exercise technology specifically addressed these factors when developing enhanced performance. From the onset, the technology was targeted as a method of training pure acceleration with gravity free inertia.

The limiting factor in developing higher levels of acceleration is equilibrium (balance and coordination). A body will only accelerate at a rate in which it can maintain equilibrium. Loss of equilibrium is the termination of focused acceleration and thus applied efficient motion. The primary factor in developing equilibrium is the enhancement of neurological control in the body. Impulse Inertial Exercise was conceived as a neurological training tool for the development of superior equilibrium and controlled acceleration against inertia.

All forms of Impulse Inertial Exercise Training are anaerobic. This type of training targets fast twitch muscle (type 2a and 2b); developing significant power in motion, while simultaneously developing joint synergy in the slow twitch portion of joint stabilizers (type 1). The results are higher levels of coordinated muscle contraction, graceful fluid motion, efficient joint stability and mobility, creating a more powerful you. Additional benefits are better metabolism, more elastic connective tissue, and stronger bones.

Impulse Inertial Exercise Training provides an exercise regime where in the user can experience higher levels of acceleration by developing equilibrium in a safe controlled environment. This creates motion knowledge when applied to the real world that yields higher levels of performance.

A force that causes something to accelerate is called an impulse. Isaac Newton figured it all out when he postulated \( F=ma \) (Force=mass \times acceleration). The resulting force \( F \) is the inertia created by the action. Thus, Steve named the product the Impulse Inertial Exercise Trainer.

About Our Product

We believe quality is the key to excellence. Provide a quality tool coupled with a quality exercise program and you’ll get a high quality physical specimen. Our training programs were developed (from 1983 to the present) in partnership with some of the highest level winning athletes in modern history. We never stop refining our programs, continually searching for better solutions to human performance. Our products don’t break. Our patients and athletes don’t break either. If it moves, it is because of an impulse.

The workout programs, protocols, and training philosophy contained in this manual are tried and proven. They have, with the aid of many professional coaches, trainers, and therapists, taken years to develop. These programs and protocols are currently used by many MBL, NFL, PGA, and WTA athletes and teams (not to mention many other pro sports). We hope you enjoy using them as you strive to help yourself and others in human performance.
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Training Philosophy

We’ve developed a philosophy for maximizing the neural learning experience throughout all Impulse exercise regimes. Thus, maximizing the transfer of skills learned in the exercise to performance on the field of play. Applied from the start, this greatly improves progress and subsequent real life performance. The goal of Impulse exercise is to develop beautiful, efficient, powerful motion. We call this philosophy:

STAR

Stance / Posture Target Activation Release

Stance: The most important aspect of an IT regime is stance. Stance is where and how the feet are placed on the ground. This governs the body’s posture during exercise. Stance affects the vestibular (balance) mechanisms and, therefore, core stability (am I vertical or leaning toward one side or the other?). Pay close attention to foot placement, width, and weight distribution on each foot. IT should be preformed with about 80% body weight on the balls of the feet (the heel will just barely be on the ground with about 20% body weight distribution). Feet should be parallel with a neutral stance of 11 inches apart or less. If staggered front to back, the parallel alignment of the feet should be less than 11 inches. Progressing to more challenging exercise will involve a narrower stance such as heel to toe or foot in line. A good stance will naturally load core muscles, stabilizing while challenging balance.

Posture: Posture is the alignment of bones from the floor through the top of the head and governs the efficiency of energy flow. Lost posture is lost energy flow. Pay particular attention to neck, upper back, and lower back alignment. In general, extending the head as high above the shoulders as possible will produce excellent posture. Stand tall.

Exercise repetition should be accomplished with excellent form, flow, and beauty of motion in mind. As the body fatigues, the mind will convince the body that posture is not important and motion will become ugly. Learning to maintain proper head position and posture while fatigued is an important benefit of IT. Focus on excellent posture from the first repetition to the last in each exercise, especially during fatigue.

Target: Select a specific target in line with the force direction of the IT exercise. Target is the ultimate destination of where energy is projected. Imagine throwing a ball at a bottle. The bottle is the target. Targeting sets the body for natural neural learning, redirecting the brain from conscious control of body motion to goal oriented control of stance and posture. Targeting requires a firm foundation which means stability. Excellent core stability can only be developed with excellent posture. Excellent posture requires proper stance. Therefore targeting is secondary to stance. In functional and efficient motion, muscles work best after a target in space has been acquired. Moving the body with a target in mind is essential in developing confidence in motion. Confidence is the key to finding new talent.
As exercise progresses, and fatigue sets in, the mind will forget about the target. The result is a loss of stance, posture, balance and ultimately the goal of the exercise. Without balance there is no functional activation. Focusing on a target will teach posture and balance during increased levels of fatigue.

**Activation:** This is the acceleration of muscle contraction. The energy involved is constantly changing. Understanding energy needs for efficient motion control is critical in any physical activity. Excessive energy output, too soon, will cause loss of stance and posture, disrupting energy flow. Too little energy, and there is no motion. The purpose of IT is to create higher levels of energy throughout the entire regime. This develops an instinctive knowledge of energy needed to complete the exercise session.

Judgment of energy reserves is generally incorrect (a natural human phenomenon). Proper activation with IT will develop an understanding of true energy levels. This new knowledge will help in governing future aggressiveness in muscle activation. Each repetition should be performed with enough energy to accomplish at least two repetitions per second throughout the entire exercise. In general, go as fast as possible while maintaining stance and posture. When fatigue challenges control of posture or targeting slow down just enough to regain control. Do not sacrifice posture or target for activation. If necessary exercise slower than the two repetitions per second as posture and target are essential to the experience. As time progresses, greater power and energy management potential will develop. Ultimately stance, posture, and targeting will become more manageable. Energy levels can be controlled throughout the exercise.

**Release:** Release is the transition from muscle acceleration to deceleration, the antithesis of activation. Energy cannot go from one place to another if it is not released. An improper release wastes energy, creating a loss of stance, posture, and target. Activation will be inhibited because balance is destroyed. Release should always be a controlled smooth transition away from activation preparing for the next repetition.

As fatigue sets in, poor release control will manifest itself without warning. The symptoms are a desire to change stance, posture, and targeting and are important to recognize with IT. Fatigue of both mind and body creates a desire to prematurely let go of energy and rest. Developing the maturity to control release while fatigued is crucial in the development of beautiful, powerful, and efficient motion. Seek smooth, controlled flow in the release.

**STAR**- The foundation of an excellent training and conditioning experience.
If it looks beautiful, then it is. If it looks ugly, it is not Impulse.
Operational Techniques
Tonic & Phasic

Your Impulse is fundamentally a simple machine. A sled is on a guide track with a rope attached to it. The rope travels through a series of pulleys which the user pulls to accelerate the sled. The center of the track has pulleys which reverse the travel direction of the rope when the sled passes them. The user must decelerate the sled before re-accelerating the sled in the opposite direction for the cycle to begin again. Fundamentally the exercise is a start stop start routine.

This mechanism makes the Impulse Inertial Exercise Trainer inherently safe. All of the weight used in exercise is on the sled, so there is nothing to drop on the user. The energy required in stopping the sled is created purely by the user during the start phase. The only forces the user receives are the forces the user produces. There is no gravity to add additional acceleration forces to the weight. Operation of the machine is predicated on the coordination of the operator. If the operator loses coordination in operating, the machine just stops working. Coordination of the machine is controlled by the weight on the sled. The more the weight the lower the level of coordination is required to operate the machine. To progress to higher levels of coordination simply begin exercise with heavy weight and every 10 or so reps reduce the weight incrementally (i.e. 17.5 pounds to 7.5 pounds to 2.5 pounds to just the sled). Thus, the user can experience higher levels of acceleration in a safe controlled environment.

Tonic - There are two techniques in the application of Inertial Exercise. The first is called tonic. Incorporate this technique by keeping constant tension on the rope as you accelerate and decelerate the sled throughout the entirety of each repetition. The neurological affect of this technique automatically recruits the antagonistic muscle groups of any motion pattern. This promotes excellent muscle/joint synergy while simultaneously building core stability. Here core stability is the foundation for the energy produced by the extremities. It is essential in training injury free high performance activity while preparing the body for performing the second technique which we call phasic. All of our exercise programs begin with the tonic technique before exercise in the phasic technique. Essentially there will never be slack in the rope when performing the tonic technique.

Phasic - The phasic technique is performed by accelerating the sled and then releasing tension (creating slack in the rope), allowing the sled to slide freely, and catching the sled at the appropriate exercise position (removing slack in the rope). The stopping forces imposed on the body when utilizing this technique are two to three times the force of the tonic technique for the same exercise and range of motion. Here the core is more than the foundation for energy produced by the extremities; it is the primary energy source conducting explosive energy through out the extremities. This technique develops series elastic stretch on connective tissue and muscle. When used with gentle force it is excellent for rehabilitation of tendonitis. Used with aggressive force, it is excellent in developing explosive starting and hitting power. Essentially this technique will create a pop in the rope with each repetition. Note: it is unadvised to begin a phasic workout without first warming up with the tonic technique for the phasic exercise you will perform.

The technique you elect to use is dependent on the function you are training. Remember to always start with tonic (as a warm up) before moving to phasic techniques. When applying Inertial Exercise Training always use the STAR philosophy as the fundamental foundation to your work.

We have developed separate protocols for each of the workout programs described in this manual. These are presented as a foundation for developing your understanding of the variety and depth of utility your Impulse Inertial Exercise Trainer provides for you.

This technology has proven to be superior in developing balance, coordination, functional power, and hypertrophy. With one machine you can accomplish more than other older technologies combined currently used for these purposes and in less time.
The secret to performance is balance. A body will only accelerate at a rate in which it can maintain equilibrium (balance). Balance is coordination. Therefore all our workout programs center on coordination first and energy expenditure second. The fundamental process is to develop properly balanced motion technique first and then add power while maintaining the learned technique. If the technique breaks down simply back off on the power until technique is regained and add the power back while concentrating on technique.

Pre Training Considerations

In order to achieve the best results with Impulse Inertial Exercise Training you will want to be sure your subject is prepared with adequate balance and joint mobility. Possessing proper range and basic control of motion will insure receipt of all of the benefits of this technology. Always evaluate and train motion technique first. Then train the execution of power using the trained motion technique. The following evaluation is a great start in preparing for the next step. If the subject has good patellar stability and scapular mobility then it is time to move on to our workout programs.

Balance Evaluation – Because IET automatically engages muscle synergy it is an excellent tool for evaluating balance in motion. Poor synergy results in poor equilibrium producing inefficient energy transfer and ultimately injury. The IET motion evaluation is quick and simple. Be sure to incorporate our STAR philosophy when using balance evaluation (see section on Training Philosophy ~ STAR).

Instability in two particular bones of the body causes the vast majority of injury and poor performance. They are the patella and the scapula. The first test is for patellar stability. An unstable knee (patella) cannot conduit energy from the ground to the core and visa versa. If the core cannot conduit energy from the ground it can not generate equilibrium nor conduit forces to the upper extremities, thus low performance. Poor equilibrium is a precursor for injury. The second test is for scapular mobility. Poor scapular mobility prevents the core from utilizing the shoulders for balance and results in poor equilibrium. This also prevents the larger back muscles (serratus, rhomboids, et al) from assisting in active arm motion depriving the shoulder of range of motion and creating an environment for rotator cuff and elbow injury. Test both legs and then both arms.

Patellar Stability - Use the exercise at right to evaluate patellar stabilization and core equilibrium. With 7.5 pounds on the sled and the pulley at ankle level perform hip rotation with the active leg while the standing leg knee is slightly bent (10~15 degrees). Make sure the active leg heel crosses past the toe of the standing leg foot. 80% of body weight should be on the ball of the standing foot with the strap on the active foot (not the ankle). 15 or so reps demonstrate the subject’s abilities. If the standing knee is unstable and balance is poor you are observing patellar instability.
Scapular Mobility - Use the exercise at left to evaluate scapular mobility and core equilibrium. With 7.5 pounds on the sled and the pulley at shoulder level perform scapular push (protraction) with the active arm while the hand of the inactive arm is placed behind the head and the elbow pulled back parallel with the shoulders. Make sure the active arm elbow is straight with the entire action being at the shoulder. 80% of body weight should be on the balls both feet standing heel to toe. Do not perform this exercise with trunk or hip rotation. If the shoulder is not performing the action you have scapular immobility. With scapular immobility expect to see issues of poor balance.

Discovering and correcting instability and immobility problems will help greatly in producing a better injury free athlete.

If you or your subject have these deficiencies, correcting and developing proper performance can usually be accomplished in one training session. Proceed as follows:

First address patellar stability. Note; the subject may require a balance aid when initially beginning training. For best results a staff, walking stick or broom handle will suffice as long as the hand grasping the stick is above hip level. Always perform this training with the tonic technique. Train both legs.

Perform the same exercise as the test with 17.5 pounds on the sled with a set of 30 reps then rest for 2 or so minutes. Place the weights on the sled in the following manner: 2.5 pounds first, 5 pounds on top of the 2.5, and 10 pounds on top of the 5. The intensity should be low, looking for balance and knee stability. If at the end of the first set, the knee is still unstable add 10 pounds (27.5 pounds on the sled) and perform another set of 30 reps with low intensity. It may take as many as 3 sets before you see changes in stability. When you see the knee responding in a stable manner, finish that set and rest another 2 minutes. During the next set after about 5 reps remove 10 pounds while the subject is exercising. Do not stop the exercise and remove the weight, continue exercising while the weight is removed. The acceleration of the sled will automatically increase and for the next few reps instability will reappear and then the knee will again become stable. Finish the set and continue the process with each successive set until you have 7.5 pounds on the sled. At this point you will perform sets while the subject attempts to become less and less dependent on the staff for balance. The easiest way to do this is to ask the subject to lift the staff off of the floor while exercising. Generally this process takes less than 4 sets and with serious instabilities 8 sets or 12 to 20 minutes.

This new learned ability may be permanent though often it takes 3 sessions done on separate days for lasting effect. The first session will be the longest with subsequent sessions generally being 3 sets. This new skill set prepares the body for our STAR Workout Programs which will enhance the subjects' motion knowledge on the field. It is doubtful the skill will alone (without programmed training) increase field performance.

Second address scapular mobility. The process is the same without the need for balance assistance. Perform the same exercise as the test using heavy weights to train initial motion technique. As mobility progresses remove weight. If mobility regresses add weight.

With these new skill sets, progress to workout programs and it is best to do so as soon as possible on the same day.
Notes
Workout Programs

All of our workout programs are designed as neurological tune-ups and are appropriate in increasing performance in all sports.

You will find in the front sleeve of this manual a DVD titled "STAR Workouts" with video of how to perform these exercises.

Our programs are extremely productive in giving the athlete an increase in range of motion and/or fluidity of motion while preserving joint stabilization. This is extremely important in preventing micro trauma while performing high performance athletic feats. Micro trauma not only requires the application of ice for immediate relief, long term recurrence will cause serious deformation of the joint tissues ultimately resulting in surgery. These programs specifically target the enhancement of joint stability in motion first and the adaptation of transferring power through the joint (while stabilized) second. They are not only beneficial in preserving the integrity of the body; they will develop the utility of being more efficient in energy delivery. They will give you an all-round neurological tune up beneficial to the coordination of the rest of your workout regime or action in the field. Simply said, if you utilize these programs in your general work out you will have, in the field, more energy and less injury.

For best results, master any of the STAR stabilization programs before adding the anaerobic programs to your regime.
STAR Stabilization Program - Our first programmed exercise regime was designed in collaboration with Phil Donley (MBL consultant). Originally intended as a rehab, post rehab and injury prevention program it was quickly recognized as a performance enhancement program. This is a 30–40 minute workout for all ages, activities, and sports which can be performed daily but will provide excellent results if done two to three days a week (i.e. Monday – Wednesday – Friday). In general exercise movement patterns and stance balance requirements are not as complex as the STAR v.5 programs. Trainers and therapists can pick and choose appropriate individual exercises for specific rehabilitation applications.

We suggest you perform this workout at a level of energy expenditure equal to what you perceive is 50% of your max power. You should read and learn the section of STAR before thinking about adding this work out to your regime. If you are going to use your Impulse for the purpose of training high power strikes (super performance training), then it is EXTREMELY IMPORTANT that you begin your workout with this regime first and then progress to the striking routines. This can also be said of enhancing your bench press, squat or clean and jerk.

**Technique:** Tonic.

**Pulley position:** As specified.

**Weight:** 7.5 pounds on the sled for all exercises.

**Count:** 30 reps per exercise at about 50% perceived power. Move immediately from one exercise to the next as with super sets.

**Note:** Performed right side then left side.

**Attachment:** Ankle strap for all exercises in its loosest configuration.

**Stance:** As positioned for each exercise.

**Critical Rules:** Never load more than 20% body weight on heels. Always have a target with you eyes. Keep low back in loaded posture. Stand Tall.
Form First
If it looks good it probably is.
Stance Target Activation Release
**The STAR v.5 Workout Programs** - These programs are a hybrid of our Stabilization Program. They consume approximately 15 minutes. Exercises in these programs are more complex than the STAR Stabilization Program and challenge balance and equilibrium to a greater degree. We suggest you begin these workouts at what you perceive is 50% of your max power. When you’ve mastered these exercises with good STAR, increase the power level to 75%. If at the higher power levels you lose equilibrium back down on the power to a point where you regain equilibrium. When confidence and control returns add the power back on. Technique is more important than brute force. You should read and learn the section on STAR before adding this work out to your regime. If you are going to use your Impulse for the purpose of training high power strikes (super training), then it is EXTREMELY IMPORTANT that you begin your workout with this regime first and then progress to the striking routines, sports specific, and super training.

We call these the v.5 Programs because they are the 5th generation of philosophy in how to incorporate STAR in a workout. The principal changes are in the extremely narrow stance and complexity of motion in each exercise.

**The Warm up** - General preparation for any workout. Originally designed as preparation for Super Training this can also be used as a diagnostic tool to test scapular mobility, knee stability, and balance of an individual.

This is a 5 minute warm up program. It prepares the entire body for action by tuning up balance and coordination while warming up all the muscles and joints in the body.

**Technique:** Tonic.

**Pulley position:** Ankle level.

**Weight:** 10 pounds on the sled for all exercises.

**Count:** 30 seconds per exercise at about 60% perceived power.

Concentrate on no more than 10 seconds between each exercise as if these were super sets.

**Note:** Performed right side then left side.

**Attachment:** Ankle strap for all exercises in its loosest configuration.

**Stance:** See “Stance During Exercise” on the STARv.5 Prep chart bottom. 80% body weight on the balls of each foot.

**Critical Rules:** Never load more than 20% body weight on heels. Always have a target with you eyes. Keep low back in loaded posture. Stand Tall.
The STAR v.5 Prep Workout - Performance enhancement for the adolescent athlete of all sports. It is a total body neurological tune-up giving the young athlete complete body spatial awareness with joint and core stability resulting in better agility, power in throwing, stronger kicking, and faster sprinting. Designed for ages 8 thru 14 it is a 15 minute workout which can be performed daily but will provide excellent results if done three days a week (i.e. Monday – Wednesday – Friday). It is not intended for rehabilitation purposes because of the complexity and intensity of the exercises.

It requires about 15 minutes to complete and has proven a performance builder in that age group.

Technique: Tonic.

Pulley position: As specified.

Weight: 5 pounds on the sled for all exercises.

Count: 30 reps per exercise at about 60% perceived power. Move immediately from one exercise to the next as in super sets.

Note: Performed right side then left side.

Attachment: Ankle strap for all exercises in its loosest configuration.

Stance: See “Stance During Exercise” on the chart bottom. 80% body weight on the balls of each foot.

Critical Rules:
Never load more than 20% body weight on heels.
Always have a target with you eyes.
Keep low back in loaded posture. Stand Tall.
ImpulseHP STARv.5 Prep Workout

5 pounds on sled

1. Toss
2. Lunge
3. Catch
4. Shove

Head

5. Kick
6. Skate
7. Slice
8. Step

Thigh

9. Sweep Out
10. Pinch
11. Sweep In
12. Curl

Ankle

Exercise Right Side then Left With Each Exercise 30 reps for tune up 30 seconds for Anaerobic Conditioning

For more information on Impulse workouts visit the programs page at www.impulsepower.com

1 800 964 2362
The STAR v.5 Workout Programs

**STAR v.5** Performance enhancement for the adult athlete of all sports. This Program is a total body neurological tune-up producing complete body spatial awareness with joint and core stability resulting in better agility, power in throwing, stronger kicking, and faster sprinting. Designed for ages 15 and older as a 15 minute workout which can be performed daily but will provide excellent results if done three days a week (i.e. Monday – Wednesday – Friday). Athletes report superior performance on the field when they perform this workout within 24 hours of competition. It is not intended for rehabilitation purposes because of the complexity and intensity of the exercises.

It is a component of many professional athletes training regimes.

**Technique:** Tonic.

**Pulley position:** As specified.

**Weight:** 7.5 pounds on the sled for all exercises.

**Count:** 30 reps per exercise at about 60% perceived power. Move immediately from one exercise to the next. To use this as an anaerobic workout use 30 seconds per exercise at 75% perceived power. Move immediately from one exercise to the next as in super sets.

**Note:** Performed right side then left side.

**Attachment:** Ankle strap for all exercises in its loosest configuration.

**Stance:** See “Stance During Exercise” on the chart bottom. 80% body weight on the balls of each foot. The narrow stance is designed to promote balance and equilibrium.

**Critical Rules:** Never load more than 20% body weight on heels. Always have a target with you eyes. Keep low back in loaded posture. Stand Tall.
Impulse HP STAR v.5 Workout

7.5 pounds on sled

Exercise Right Side Then Left With Each Exercise 30 reps for Tune up or 30 seconds for Anaerobic Conditioning
Anaerobic Workouts - Designed to anaerobically challenge the athlete to the point that neuromuscular control breaks down, these workouts allow the athlete to experience the symptoms of this break down without the threat of micro trauma to tissue or the possibility of traumatic injury often associated with that level of fatigue during competition. The results of this break down are loss of balance, loss of concentration, and loss of good stance/postural control. These are the areas where, in actual performance on the field of action, the athlete experiences a loss of performance (lose the game), frequent micro trauma injury (requiring ice/heat, etc.), and possible acute injury (surgery). Knowledge in how to manage and cope with the body while fatigued in this manner gives the experienced athlete a broader arsenal of useful tools with which to compete and emerge not only a champion but an uninjured champion.

It is recommended that you NOT perform this program if you are injured or recovering from an injury and have not been cleared by a physician for competition. While the purpose of this exercise program is anaerobic endurance, ultimately resulting in injury prevention, a healthy body is a prerequisite in order to sustain the extreme requirements placed on the body while performing this workout circuit. We recommend you master the STAR v.5 workout before addressing our anaerobic workouts. Addressing these workouts without excellent balance and equilibrium can develop bad motion patterns which on the field of play may cause injury.

If you are in competition presently then you should not perform these workouts more than two days per week (at 75%+ energy). Out of season exercise can be as much as every day or 3 days per week depending on your workout schedule. This workout should be performed AFTER free weights and NEVER BEFORE free weights. After 5 workouts (about 2 weeks) this workout can be performed every day at 50~60% energy level. These workouts give the best results when performed at 75%+ energy output. For a lower energy workout designed for total body stabilization consider our STARv.5 or Stabilization Program.

Pay close attention to the STAR Training philosophy for maximum effectiveness. Note, however, that as you neurologically breakdown, your mind will attempt to lose interest in what and how you are performing. You will find excuses, taking longer time periods to change to the next exercise. You will lose your balance in the initial workouts and experience frustration. You may be aggravated to the point that you just want to quit. These are the most important aspects of the workout. Don’t fall prey to your mind’s childish nature. When anaerobically stressed, practice managing your energy output and pay close attention to your STAR.

Energy expenditure should be between 75%~80% of what you perceive your ability at 100% would be with this technology. In time, your experience will modify your knowledge of your perceived energy level. Coordination, good form, and beauty are more important with this workout than brute force. If you lose any of your excellent form then back down your energy level (typically reps per second) until you regain the excellent form. Initially, during the first several workouts it will require a considerable amount of concentration to regain control of form. As time (3 to 5 weeks) progresses, you will find more energy and recover quickly from lost form.

The Stance with these programs is much wider than that of the STAR stabilization or Star v.5 programs. This allows the body to execute more force through the core.
Notes
Men’s Anaerobic/Cardio Workout - This is essentially a high intensity interval cardio workout. As each muscle group fatigues the user changes to another muscle group ensuring continuous high performance activity. In the 150 plus pound male this workout will consume approximately 400 calories when all three circuits are performed. The 30 minute cool down following this workout will consume 350 plus calories.

Be sure to hydrate before performing this workout.

Pulley position: 1” above belly button for all exercises in the circuit.

Weight: Initially 10 pounds on the sled for all exercises. When your talent progresses to the ability to complete 2 full circuits while maintaining 2 repetitions per second with excellent stance and posture change to 7.5 pounds on the sled and 3 circuits.

Count/Circuit: Initially 30 repetitions each exercise at 2+ repetitions per second then shift to the next exercise. Concentrate on no more than 5 seconds between exercise changes. Initially 2 circuits progressing to 3 circuits. Each circuit is approximately 10 minutes so 3 circuits will consume 30 minutes.

Attachment: Ankle strap for all exercises in its loosest configuration.

Stance: See chart for each exercise but no wider than 11 inches. 80% body weight on the balls of each foot. The wider stance is designed to facilitate more power while developing balance and equilibrium.

Generalities: Acquire a visual target and focus. Fixed head with good head posture. Excellent Stance/Posture at all times. Weight should be on balls of feet in all exercises.

Critical Rules: Never load more than 20% body weight on heels. Always have a target with eyes (visualize your head movement). Keep low back in loaded posture.
Men’s Anaerobic/Cardio Workout
10 pounds on the sled ~ 2 circuits progressing to 7.5 pounds on the sled ~ 3 circuits

Form First
If it looks good it probably is.
Stance Target Activation Release
Women’s Anaerobic/Cardio Workout - This is essentially a high intensity interval cardio workout. As each muscle group fatigues the user changes to another muscle group ensuring continuous high performance activity. In the 110 to 130 pound female this workout will consume approximately 350 calories when all three circuits are performed. The 30 minute cool down following this workout will consume 300 plus calories.

This program targets more core and less extremities than the male workout. Be sure to hydrate before performing this workout.

Pulley position: 1” above belly button for all exercises in the circuit.

Weight: Initially 10 pounds on the sled for all exercises. When your talent progresses to the ability to complete 2 full circuits while maintaining 2 repetitions per second with excellent stance and posture change to 7.5 pounds on the sled and 3 circuits.

Count/Circuit: Initially 30 repetitions each exercise at 2+ repetitions per second then shift to the next exercise. Concentrate on no more than 5 seconds between exercise changes. Initially 2 circuits progressing to 3 circuits.

Attachment: Ankle strap for all exercises in its loosest configuration.

Stance: See chart for each exercise but no wider than 8 inches. 80% body weight on the balls of each foot. The wider stance is designed to facilitate more power while developing balance and equilibrium.

Generalities: Acquire a visual target and focus. Fixed head with good head posture. Excellent Stance/Posture at all times. Weight should be on balls of feet in all exercises.

Critical Rules: Never load more than 20% body weight on heels. Always have a target with eyes (visualize your head movement). Keep low back in loaded posture.
Women’s Anaerobic/Cardio Workout
10 pounds on the sled ~ 2 circuits progressing to 7.5 pounds on the sled ~ 3 circuits

Beauty First Stance - Posture – Activation – Release

1. Leap

2. Knee Extension R & L

3. Hand Rotation from Hip R & L

4. Internal Rotation Arm R & L

5. Swing out from Trunk R & L

6. Standing Hip Rotation R & L

7. Straight Pull R & L

8. Leg Aduction R & L

9. Kneel and Press R & L
Hypertrophy Training

Many of these exercises generate forces in excess of 100 pounds. These forces are not possible unless you have secured your impulse to the floor or a platform. Approaching hypertrophy gains with Impulse Inertial Exercise is somewhat different than other forms of resistance training. Because there is no gravity or external elastic force, the determining factor in creating micro damage is intensity of exercise and duration of exercise. The resistive force is the pure inertia of the mass on the sled (weight). The mass of the sled affects the acceleration rate of contraction of the primary muscle in development and thus the rate of fatigue. The following is a generic protocol for hypertrophy development with Impulse Inertial Exercise. This protocol can be used when targeting any specific muscle (i.e. quads, triceps, hamstring, pecs).

Choose the muscles you wish to develop from our BASIC EXERCISE STEUP section. In this example, we examine the curl. Perform 5 sets in the following manner:

Sets 1 ~ 3 --- Weight on the Sled - 7.5 pounds
Technique – Tonic  RPS – 2+
Curl 30 seconds at 80% power with each set
1 minute rest between sets
Rest 2 minutes
Set 4 --- Weight on the Sled - 2.5 pounds
Technique – Phasic  RPS -1.5+
Curl 30 seconds at 80% power
Rest 2 minutes
Set 5 --- Weight on the sled – 0 pounds
Technique – Tonic  RPS - 3+
Curl 30 seconds at 80% power as fast as possible
while maintaining STAR

Discussion- The function of this progression is to fatigue the primary muscle selected. Forearm flexors, deltoids, and trapezius will also become fatigued. As the bicep fatigues it is important to maintain form and posture. Resist substitution. Technique is everything.

Sets 1 ~ 3 are tonic with 7.5 pounds. This weight is known to produce the maximum torque in fast twitch fiber with this technology. It is also known to quickly produce fatigue and high lactic acid levels (approximately 6 mmol/L). Hence the 1 minute rest between these sets. Power output at the end of these sets will be 25% to 50% of initial power. The tonic technique and the phasic technique produce equal levels of lactic acid per set yet the total force (sum of all work) produced by tonic is greater than phasic. Phasic however produces two to three times the peak force per repetition. The tonic technique is chosen first for the fatigue factor and also the joint stabilization factor, preparing the joints for the 4th set which is phasic. The two minute rest is a recovery period from the lactic acid.

Set 4 is phasic with 2.5 pounds. As the muscle is fatigued, it is able to accelerate the lighter mass at the same rate or greater than with the 7.5 pounds. This is an explosive ballistic action where, even though the sled is lighter, the initial forces will be far greater than the first 3 sets (50% to 100% greater). The ratio of fatigue will also be greater and by the end of the set, power may be as little as 10% to 20% of initial power. Again, the two minute rest is a recovery period from the lactic acid.

Set 5 is tonic with 0 pounds on the sled. This allows for extremely high contraction acceleration while preserving joint synergy. Fatigue will be comparable to that of set 4.

Depending on the level of fitness, expect varying degrees of soreness (DOMS) within 24 hours and complete recovery between 48 and 72 hours. Like other resistance training programs this protocol can be effectively used 2 to 3 days a week alternating primary muscles and muscle groups (i.e. quads and biceps on Mondays and Wednesdays then triceps and hams on Tuesdays and Thursdays). After a 30 minute rest any of our STAR stabilization programs can be performed.
Basic Exercise Setups

The following are basic exercise setups useful in developing hypertrophy or rehab programs. Use the EXERCISE VS. JOINT MOTION DIRECTORY on this page or the MUSCLE INDEX on page 59 to choose exercises. Refer to the HYPERTROPHY TRAINING or CLINICAL TRAINING sections for protocols.

EXERCISE VS. JOINT MOTION DIRECTORY

ELBOW EXERCISE: 29

\[
\begin{align*}
ELBOW \text{ } \text{Extension} & \quad \text{\textit{from 45° in neutral}}} & \quad 29 \\
ELBOW \text{ } \text{Flexion} & \quad \text{\textit{from neutral}}} & \quad 29 \\
ELBOW \text{ } \text{Flexion} & \quad \text{\textit{to 90° shoulder at 90°}}} & \quad 29 \\
ELBOW \text{ } \text{Flexion} & \quad \text{\textit{to 90° shoulder in neutral}} & \quad 29 \\
ELBOW \text{ } \text{Pronation - Internal Wrist Rotation} & \quad \text{\textit{supination}} & \quad 30 \\
ELBOW \text{ } \text{Supination}} & \quad \text{\textit{External Wrist Rotation}} & \quad 30
\end{align*}
\]

HIP EXERCISE: 30

\[
\begin{align*}
HIP \text{ } \text{Abduction} & \quad \text{\textit{}}} & \quad 30 \\
HIP \text{ } \text{Adduction} & \quad \text{\textit{}}} & \quad 30 \\
HIP \text{ } \text{Extension} & \quad \text{\textit{}}} & \quad 31 \\
HIP \text{ } \text{Flexion} & \quad \text{\textit{}}} & \quad 31 \\
HIP \text{ } \text{Rotation} & \quad \text{\textit{}}} & \quad 31
\end{align*}
\]

KNEE EXERCISE: 31

\[
\begin{align*}
Knee \text{ } \text{Flexion} \text{ } \text{Standing}} & \quad \text{\textit{}}} & \quad 31 \\
Knee \text{ } \text{Extension} \text{ } \text{Seated}} & \quad \text{\textit{}}} & \quad 32 \\
Knee \text{ } \text{Extension} \text{ } \text{Standing}} & \quad \text{\textit{}}} & \quad 32 \\
Knee \text{ } \text{Flexion} \text{ } \text{Seated}} & \quad \text{\textit{}}} & \quad 32 \\
Knee \text{ } \text{Rotation} \text{ } \text{Standing}} & \quad \text{\textit{}}} & \quad 32
\end{align*}
\]

SHOULDER EXERCISE: 33

\[
\begin{align*}
Shoulder \text{ } \text{Extension} \text{ } \text{from 45°}} & \quad \text{\textit{}}} & \quad 33 \\
Shoulder \text{ } \text{Extension} \text{ } \text{from 90°}} & \quad \text{\textit{}}} & \quad 33 \\
Shoulder \text{ } \text{Extension} \text{ } \text{from full overhead}} & \quad \text{\textit{}}} & \quad 33 \\
Shoulder \text{ } \text{Extension} \text{ } \text{to hyperextension}} & \quad \text{\textit{}}} & \quad 33 \\
Shoulder \text{ } \text{External Rotation} \text{ } \text{in Horizontal "Rotator Cuff"}} & \quad \text{\textit{}}} & \quad 34 \\
Shoulder \text{ } \text{External Rotation} \text{ } \text{in Neutral}} & \quad \text{\textit{}}} & \quad 34 \\
Shoulder \text{ } \text{Flexion} \text{ } \text{from 135°}} & \quad \text{\textit{}}} & \quad 34 \\
Shoulder \text{ } \text{Flexion} \text{ } \text{from neutral}} & \quad \text{\textit{}}} & \quad 34 \\
Shoulder \text{ } \text{Horizontal Abduction}} & \quad \text{\textit{}}} & \quad 35 \\
Shoulder \text{ } \text{Horizontal Flexion Abduction}} & \quad \text{\textit{}}} & \quad 35 \\
Shoulder \text{ } \text{Internal Rotation} \text{ } \text{from Neutral}} & \quad \text{\textit{}}} & \quad 35 \\
Shoulder \text{ } \text{Internal Rotation} \text{ } \text{in Horizontal "Rotator Cuff"}} & \quad \text{\textit{}}} & \quad 35 \\
Shoulder \text{ } \text{Neutral Abduction}} & \quad \text{\textit{}}} & \quad 36 \\
Shoulder \text{ } \text{Neutral Adduction}} & \quad \text{\textit{}}} & \quad 36
\end{align*}
\]

TRUNK EXERCISE: 36

\[
\begin{align*}
Trunk \text{ } \text{Rotation} \text{ } \text{Forward}} & \quad \text{\textit{}}} & \quad 36 \\
Trunk \text{ } \text{Rotation} \text{ } \text{Rear}} & \quad \text{\textit{}}} & \quad 36
\end{align*}
\]

WRIST EXERCISE: 37

\[
\begin{align*}
Wrist \text{ } \text{Extension}} & \quad \text{\textit{}}} & \quad 37 \\
Wrist \text{ } \text{Flexion}} & \quad \text{\textit{}}} & \quad 37 \\
Wrist \text{ } \text{Radial Deviation}} & \quad \text{\textit{}}} & \quad 37 \\
Wrist \text{ } \text{Ulnar Deviation}} & \quad \text{\textit{}}} & \quad 37
\end{align*}
\]
Elbow Exercise:

**Elbow Extension from 45° in Neutral**
Primary Muscle Concerned: Triceps
Pulley Position: Top Position
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**Elbow Flexion from Neutral**
Primary Muscle Concerned: Brachialis
Biceps Brachia
Brachioradialis
Pulley Position: Level with Ankle
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**Elbow Flexion to 90° Shoulder at 90°**
Primary Muscle Concerned: Biceps Brachia
Brachioradialis
Brachialis
Pulley Position: Level with Ankle
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**Elbow Flexion to 90° Shoulder in Neutral**
Primary Muscle Concerned: Brachioradialis
Brachialis
Biceps Brachia
Pulley Position: Level with Ankle
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds
**Elbow Pronation - Internal Wrist Rotation**

- **Primary Muscle Concerned:** Pronator Quadratus, Pronator Teres, Flexor Carpi Radialis
- **Pulley Position:** Level with Waist
- **Line Apparatus:** Line Handle
- **Beginning Weight:** 17.5 pounds

---

**Elbow Supination - External Wrist Rotation**

- **Primary Muscle Concerned:** Supinator, Biceps Brachia
- **Pulley Position:** Level with Elbow in Neutral
- **Line Apparatus:** Line Handle
- **Beginning Weight:** 17.5 pounds

---

**Hip Exercise:**

**Hip Abduction**

- **Primary Muscle Concerned:** Rectus Femora, Tensor Fasciae
- **Pulley Position:** Level with Ankle
- **Line Apparatus:** Ankle Strap
- **Beginning Weight:** 17.5 pounds

**NOTES:** Initially use some form of support for balance.

---

**Hip Adduction**

- **Primary Muscle Concerned:** Adductor Longs, Adductor Magnus, Grackles, Pectineus
- **Pulley Position:** Level with Ankle
- **Line Apparatus:** Ankle Strap
- **Beginning Weight:** 17.5 pounds

**NOTES:** Initially use some form of support for balance.
**Hip Extension**
Primary Muscle Concerned: Gluteus Maximus
Gluteus Medius
Biceps Femoris
Adductor Magnus
Semitendinosus

Pulley Position: Level with Ankle
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

NOTES: *Use some form of support for balance.*

**Hip Flexion**
Primary Muscle Concerned: Iliopsoas
Vastus Intermedius
Vastus Lateralis
Vastus Medialis
Sartorius
Tensor Fasciae

Pulley Position: Level with Ankle
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

NOTES: *Initially use some form of support for balance.*

**Hip Rotation**
Primary Muscle Concerned: Biceps Femoris
Vastus Medialis,
Vastus Lateralis
Vastus Intermedius
Pectineus
Adductor Longus

Pulley Position: Level with Hip
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

**Knee Exercise:**

**Knee Flexion Standing**
Primary Muscle Concerned: Semimembranosus
Semitendinosus
Biceps Femoris

Line Position: Level with Active Ankle
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

NOTES: *Use chair or cane for support and balance.*
**Knee Extension Seated**

Primary Muscle Concerned: Vastus Intermedius
Vastus Lateralis
Vastus Medialis
Rectus Femoris

Line Position: Level with Active Ankle
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

NOTES: *Use roll to elevate knee.*

**Knee Extension Standing**

Primary Muscle Concerned: Vastus Intermedius
Vastus Lateralis
Vastus Medialis
Rectus Femoris

Line Position: Level with Active Ankle
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

NOTES: *Use chair for support and balance.*

**Knee Flexion Seated**

Primary Muscle Concerned: Biceps Femoris
Semimembranosus
Semitendinosus

Line Position: Level with Active Ankle
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

NOTES: *Use roll to elevate knee.*

**Knee Rotation Standing**

Primary Muscle Concerned: Vastus Medialis
Vastus Intermedius
Vastus Lateralis
Rectus Femoris

Line Position: Level with Bottom of Foot
Line Apparatus: Ankle Strap
Beginning Weight: 17.5 pounds

Notes: *Use cane or chair for balance if necessary.*
Shoulder Exercise:

**Shoulder Extension from 45°**
Primary Muscle Concerned: Latissimus Dorsi
Teres Major
Triceps Long Head
Teres Minor

Pulley Position: Level with Nose
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**Shoulder Extension from 90°**
Primary Muscle Concerned: Rhomboideus Major
Posterior Deltoid
Teres Major
Latissimus Dorsi

Pulley Position: Level with Nose
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**Shoulder Extension from Full Overhead**
Primary Muscle Concerned: Teres Major
Triceps Long Head
Latissimus Dorsi
Pectoralis Major
Pectoralis Minor

Pulley Position: Level with Nose
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**Shoulder Extension to Hyperextension**
Primary Muscle Concerned: Posterior Deltoid
Teres Major
Triceps Long Head
Teres Minor

Pulley Position: Level with Hand at Standing Rest
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds
Shoulder External Rotation in Horizontal "Rotator Cuff"

Primary Muscle Concerned: Infraspinatus, Teres Minor, Supraspinatus, Deltoid, Rhomboideus Major

Pulley Position: Level with Sternum
Line Apparatus: Ankle Strap over hand
Beginning Weight: 17.5 pounds

Shoulder External Rotation in Neutral

Primary Muscle Concerned: Infraspinatus, Teres Major, Posterior Deltoid, Supraspinatus

Pulley Position: Level with Sternum
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

Shoulder Flexion from 135°

Primary Muscle Concerned: Infraspinatus, Teres Minor, Supraspinatus, Anterior Deltoid

Pulley Position: Level with Sternum
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

Shoulder Flexion from Neutral

Primary Muscle Concerned: Anterior Deltoid, Coracobrachialis, Supraspinatus, Biceps Brachia

Pulley Position: Level with Knee
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds
Shoulder Horizontal Abduction
Primary Muscle Concerned: Supraspinatus; Infraspinatus; Teres Minor
Pulley Position: Level with Shoulder
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

NOTES: At the beginning of the exercise, note that the arm is at about a 45 degree angle to the rope travel.

Shoulder Horizontal Flexion Abduction
Primary Muscle Concerned: Pectoralis Major; Pectoralis Minor; Anterior Deltoid; Subscapularis
Pulley Position: Level with Acromium of Shoulder
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds
NOTES: The shoulder should be slightly extended with the line at about 90 degrees to the arm at the beginning of the exercise. Flexion should be to about 45 degrees.

Shoulder Internal Rotation from Neutral
Primary Muscle Concerned: Supraspinatus; Pectoralis Major
Pulley Position: Level with Elbow
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

NOTES:

Shoulder Internal Rotation ~ Horizontal “Rotator Cuff”
Primary Muscle Concerned: Supraspinatus; Pectoralis Major
Pulley Position: Level with Shoulder
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds
**Shoulder Neutral Abduction**

Primary Muscle Concerned: Deltoid
Supraspinatus

Pulley Position: Level with Iliiul Crest of the Hip
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**NOTES:** Shoulder should be in forward flexion to accommodate line travel in front of body. The line travel should be parallel to the position of the hips and feet.

**Shoulder Neutral Adduction**

Primary Muscle Concerned: Coracobrachialis
Pectoralis Major

Secondary Muscle Concerned: Biceps Short Head

Pulley Position: Level with Shoulder
Line Apparatus: Line Handle
Beginning Weight: 17.5 pounds

**NOTES:** The motion of this exercise should be along the coronal plane.

**Trunk Exercise:**

**Trunk Rotation Forward**

Primary Muscle Concerned: Obliquus Externus
Obliquus Internus
Pectoralis Major

Pulley Position: Level with Shoulder
Line Apparatus: Sport Handle
Beginning Weight: 17.5 pounds

**Trunk Rotation Rear**

Primary Muscle Concerned: Erector Spinae
Latissimus Dorsi

Pulley Position: Level with Shoulder
Line Apparatus: Sport Handle
Beginning Weight: 17.5 pounds
Wrist Exercise:

**Wrist Extension**
- Primary Muscle Concerned: Extensor Digitorum Communis, Extensor Carpi, Radialis Longus, Extensor Carpi Ulnaris
- Secondary Muscle Concerned: Extensor Carpi Radialis Brevis
- Pulley Position: Level with Ankle
- Line Apparatus: Line Handle
- Beginning Weight: 5 pounds

**Wrist Flexion**
- Primary Muscle Concerned: Flexor Digitorum Profundus, Flexor Digitorum Superficialis, Flexor Pollicis Longus, Palmaris Longus
- Pulley Position: Level with Eye
- Line Apparatus: Line Handle
- Beginning Weight: 5 pounds

**Wrist Radial Deviation**
- Primary Muscle Concerned: Extensor Carpi Radialis Longus, Flexor Carpi Radialis, Abductor Pollicis Longus, Extensor Carpi Radialis Brevis
- Pulley Position: Level with Heart
- Line Apparatus: Sport Handle
- Beginning Weight: 17.5 pounds

**Wrist Ulnar Deviation**
- Primary Muscle Concerned: Extensor Carpi Ulnaris, Flexor Carpi Ulnaris
- Pulley Position: Level with Waist
- Line Apparatus: Sport Handle
- Beginning Weight: 17.5 pounds
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Sports Specific

All of our workout programs develop balance, acceleration, and ultimately power in motion increasing performance on the field. Sports specific exercises target explosive impulses where they are most needed in any specific sport. Performing these exercises requires attention to detail and adherence to technique. The intent is developing excellent technique and acquiring the feel of the impulse (the sweet spot). The development of technique is a highly individualized task which depends on close supervision between an experienced coach and each athlete.

Defining the appropriate exercise for each sport activity is most important and designing specific exercises requires appropriate motion knowledge for the sport in question. Regardless of the exercise, balance and equilibrium is more important than brute force. Exercise for each set should be short in duration (10 – 15 seconds) with the athlete making subtle adjustments to stance, posture and head position with each repetition until just the right feel is acquired. The power level initially should be 50% ~75% allowing for acquiring the right feel which can take several reps to find (5~15 reps or so). Once feel is acquired, up the power gradually while maintaining technique for 10 to 20 additional reps.

These exercises can be either Tonic or Phasic, depending on the type of impulse in development. The repetitions per second are determined by the specific activity trained. With each exercise the stance is appropriate for each specific sport. The following are a few examples:

**Baseball Throwing –**

![Baseball Throwing](image1)

This exercise is performed with the tonic technique. Initial execution is done with the hip, the shoulder following and then the elbow with the whip of the forearm. The head (targeting) is relatively still with the core rotating on the spine. Performed properly, peak internal rotation forces are in the 100 ~150 foot pound range per rep. This is performed typically with no weight on the sled.

**Baseball Ball Release –**

![Baseball Ball Release](image2)

Again the action is initiated by the hip with the shoulder following and then the elbow and external rotation of the shoulder on the forearm. The strap is used here to place the forces on the extensors of the forearm. The head (targeting) is relatively still with the core rotating on the spine.

Pictured is the tonic technique with peak external rotation forces in the 50 ~ 90 pound range per rep with no weight on the sled.
Baseball Ball Strike—

This exercise is performed with the phasic technique. Initial execution is done with the hip, arms following as the core rotates and then the wrists snap popping the rope at the position of ball contact. The head (targeting) is relatively still with the core rotating on the spine. Peak striking forces are in the 150 ~ 200 pound range per rep with no weight on the sled.

Football Hitting-

The exercise at left is performed with the tonic technique. The core of the body is floating in front of the feet at approximately 45 degrees. The head is relatively stable and targeting with good back posture. The athlete must produce sufficient force per rep to maintain the float by driving with the legs while extending the arms and protracting his scaps. Peak forces per rep are in the 200 ~ 250 pound range with 7.5 pounds on the sled at the hands.

These exercises are performed with a Dual Impulse Inertial Exercise Training system.

The exercise at right is similar to the one above and performed with the Phasic technique. Note, in the striking position, the hair lifting off the head. Peak forces generated with this technique are in the 400 ~ 500 pound range per rep at the hands with 5 pounds on the sled. Energy must come from the core to the feet and back through the core to the arms in order to generate these highly explosive acceleration forces at the very last instant.

The 7.5 pound sled weight is selected here as this weight provides for the maximum torque production in the body. These exercises are much easier with heavier weight but will not produce the forces described here.
**Golf Down Swing -**

From the top position of the back swing perform the initial down swing with hip rotation having the core and arms moving with the hip. With weight distribution primarily on the balls of the feet; perform core rotation about the spine with the head still and targeting the ball location. A slight hyperextension of the hip will help with this motion. During the back swing portion of this exercise open up the hips in rotation and allow the inertia of the sled to give a good stretch without losing head position and back posture. This exercise is depicted with 7.5 pounds on the sled with peak forces in the 60 ~ 80 pound range per rep at the hands.

**Golf Ball Strike -**

This exercise is done entirely with core rotation. It is done with the phasic technique with no weight on the sled. Hip rotation is done such that weight transfer goes from the training foot to the leading foot where just at the ball contact position weight is evenly distributed between both feet. Keeping the head still and on target is most important in this drill as the shoulders and arms rotate with the trunk. The strike is done with the core and not the arms. At the follow through position release tension on the rope by quickly returning to the initiation position for the next rep and strike. Peak force per rep at the hands is in the 200 pound range.

**Discussion:** Training the athlete to create the high forces mentioned in all the above exercises is done through technique. These forces are created by training the body to exert high energy levels reflexively in time periods of 30 thousands of a second and less. The human mind cannot consciously control the body in these time frames. This is why looking for the feel of motion (the impulse) is important. In developing the motion technique for the impulse the athlete should not work to fatigue (sets should be short in duration). Perform enough excellent technique reps to remember the feel so that after some rest the exercise can be revisited with the same quality of work. In essence you are burning quality motion into the athlete’s neurological memory. Adhering to the principles of STAR and designing exercises which focus on the impulse points of athleticism will pay off in competition.

The athlete may not master proper technique in the first few sessions. Adding weight to the sled and performing the exercise in slow motion can enhance the learning curve. As technique is developed reduce the weight gradually until the athlete finds the groove. If the athlete tries to produce these forces with mind control he will not be powerful. Performance in a smooth graceful balanced flow will yield positive results and remarkable power.
Super Training

Once sports specific exercise techniques are mastered the skill learned can be applied to a higher level of motion knowledge. Sports specific training allows the athlete to develop explosive impulses and the techniques to exert them at 100% power. Super training like sports specific training focuses on technique, balance, and form of motion with the addition of performing the entire exercise at 100% energy levels. While exercising the athlete must maintain proper form while energy supplies are depleted such that they are exerting 100% of available power at all times. This helps the athlete's awareness of how he responds to fatigue.

Sets and the duration of sets can vary with one rule in mind. The duration should be long enough to fatigue the athlete considerably without going to total failure (providing for the maintenance of proper form). i.e. two to three 30 second sets with 15 minute rests between each set or three 15 second sets with 30 seconds between each set.

Examples of different set durations are as follows:

**Baseball Throwing**

A 30 second drill baseball throwing exercise consisting of a single 30 second set. Shown with force curves to demonstrate fatigue, power levels start in the 140 pound range and diminish gradually to the less than 70 pound range. With this example the athlete would be able to efficiently perform 3 sets in any one day. The athlete should not throw competitively within 72 hours of this exercise regime and will experience mild soreness the next day. Soreness will be in the posterior deltoids and travel across the chest to the abdominals then the hamstrings and calf muscles. The weakest muscles will be complaining the most. Note that these forces are consistent with those needed to throw a high 80’s to low 90’s fast ball. Exercise is performed with the tonic technique.

A 1 minute 45 second drill baseball throwing exercise consisting of three 15 second sets with a 30 second rest between sets. The force curves are shown to demonstrate fatigue. During the first set power levels are in the 140 pound range and diminish very little. The second set has power levels in the 130 pound range and diminish considerably in the last 3 seconds. The third set is in the 120 to 130 pound power range and diminishes quickly in the last 5 seconds. With this example the athlete would be able to efficiently perform 2 drills in one day with a minimum of 15 minute rest between drills. Like the 30 second drill the athlete should not throw competitively within 72 hours of this exercise regime and will experience mild soreness the next day. Exercise is performed with the tonic technique.
Just for fun

The following examples are to demonstrate the versatility of Impulse Inertial Exercise Training.

This is an example of running in place with a 30 second set using the tonic technique. The core of the body is floating in front of the feet at approximately 30 degrees. The head is relatively stable and targeting with good back posture. The athlete must produce sufficient force per rep to maintain the float by driving with the ground striking foot and opposite arm and alternating each foot and arm with each rep. Peak forces per rep are in the 100 ~ 150 pound range at each hand with 5 pounds on the sled of each machine.

This exercise could be called a bench press float. The core and upper legs are perpendicular to the floor and the athlete must produce sufficient force with a pressing motion of the arms to lift the knees off the floor such that the shins are parallel to the floor while the core hovers. The forces on the arms are in the 150 pound force range per arm per rep, with the forces on the ankles, quads, and abdomens being much greater. Performed here with 5 pounds on the sled the duration of exercise is less than 15 seconds per set. The skill in balancing arm forces to maintain the hover is considerable.

Some generalities in terms of force versus energy output to think about; With unilateral workouts one minute of tonic exercise with 10 pounds on the sled and average forces per rep at 140 pounds force at 1.6 reps per second will consume in excess of 1800 kilocalories. The same exercise in the phasic technique where average forces will be about 250 pounds force will consume 1200 kilocalories. Generally this means, at the force levels mentioned in this paragraph, 30 seconds on tonic will consume at least 900 Kcals and phasic 600 Kcals. And the 3 – 15 second drill would consume 1350 Kcals in tonic and 900 Kcals in phasic. That is a lot of energy in 45 seconds of work. Energy levels (kilocalories) will be even higher when workouts involve these levels of energy bilaterally as with a Dual system.

The high levels of energy expenditure mentioned here dictate that the athlete be well hydrated before exercise, exercise in an environment of appropriate ambient temperature (68 ~ 85 degrees Fahrenheit), and have an appropriate diet and nutrition regime.

The utility, in application, of Impulse Inertial Exercise Training is limited only to your imagination. We hope the examples we have given in this manual will help you in designing your own programs and reap the rewards of victory for your athletes.
Clinical Application

Many, many thanks to all those researchers, therapists, and trainers who shared their knowledge, time, and experience in the development of this important technology.

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Inertial Exercise WHY?

_Because without coordination there is no controlled motion._

In motion, as in life, it’s not what you do, but rather how you do what you do. How you do what you do is technique. The techniques you employ in motion arise from your experience associated with that motion. Experience revisited regularly becomes knowledge. You “just know” at what level you can do a task and at what level you can’t. You don’t think about it; you “just know.” In motion, knowledge is everything.

Motion knowledge comes from confidence of action. If you “just know” your skill to perform a task is beyond your capability, your confidence to complete the task is low. Unless circumstances are dire, you won’t even attempt the action. Skill and confidence are directly related to action and vice versa.

Most human action consists of very complex robotics. The condition of motor units, proprioceptors, fuel supplies, and connective tissue are continually monitored, recorded, and adjusted. Each action taken is the result of a prepared and activated motor program that activates many motor units simultaneously at quite literally mind-boggling speed, speeds much faster than we can perform cognizant thought but not faster than we can monitor. Each action is recorded and slightly modifies our experience of that action. These motor programs are a database of comparisons to confirm the results of a motion. The more experience we have with an action the more confidence we feel about that action. Feelings are the memory of our confirmation of movement.

Isaac Newton developed an idea that every action produced an opposite reaction. He proposed that everything had mass and that everything had motion. He postulated that mass in motion continues in its relative motion unless a force acts upon it. This property of mass to remain in motion he called “inertia”. Then he postulated that action required force, and that was what changed the motion of the inertial mass. When the motion of a mass was changed, he called the change in momentum produced by the force an “impulse”. When we move, we continually change the momentum or our body with impulses. We are taking action against inertia, and it is inertia that stimulates what we feel. Hence, all of human motion is a form of inertial exercise.
Consider the following chart:

This chart exhibits the hiking calorie expenditure for the average male carrying various loads in military knap sack configuration (Passmore, R.: Human Energy Expenditure, *Physiological Reviews*, 1955 vol.35, pp 801-875). It is important to note that in the case of 0 to 70-pound loads when walking at 3.5 mph and less (standard hiking speed) the calorie expenditure is within 2 calories. From 3 mph and slower the change in weight has little to do with the energy cost. Apparently, the energy spent here is involved in horizontal motion (gravity free) and not vertical (gravity affected). So, the work done here is involved with balance and propulsion.

Normally we don’t think much about balance and propulsion. Automatic motor programs control most of it. But when we trip, we become very aware of where we are in space. Our safe recovery depends on our ability to react to the new unexpected forces encountered.

A review of this chart demonstrates the timing of the various in line processes involved with reaction process (Swink, J.R.: Intersensory comparisons of reaction time using an electropulse tactile stimulus, *Human Factors*, 1966, vol. 8, no. 2, PP 143-145.). Obviously, if we had to think about recovery, injury is a definite possibility without the presence of protective motor programs.

As mentioned earlier, much of human motion is robotic. The mechano-receptors of the human body are sensors for our inertial guidance system. The body interprets the electrical signals from these mechanisms as position and motion. It in turn responds with electrical signals to motor units which create some form of motion that again stimulate mechano-receptors in turn creating the afferent efferent neurological flow we call coordination.

So, all of human motion is learning to control inertia.
Inertial Exercise- The Concept is Born

Although exercise without inertia is a physical impossibility, the concept of training the body in dealing with inertia in a terrestrial environment without gravity is new. Many high performance activities have little or no gravity involved. In the drive of golf, like in the pitch in baseball, less that 10% of the forces involved in the travel of the ball is affected by gravity. Dr. William McLeod (Ph.D. Biomechanics) had observed this relationship of gravity and force. As a researcher of Biomechanics, working with the Houghston Clinic (1979) in Columbus GA, he observed the rehabilitation processes involved with the throwing shoulder. He realized that all of the processes of exercise for the shoulder involved some form of gravity or elastic resistance. He also realized that throwing has little if anything to do with gravity or external elastic forces. He began searching for a method of exercise that concentrated on acceleration and deceleration. He envisioned a method of exercise that would deal exclusively with the effects of inertia on human motion.

In the pursuit of this and other biomedical interests, he discovered other professionals with like interests. With Steve Davison, Industrial Designer and Mechanical Engineer, Dr. Tom McLaughlin, Biomechanist, and Ron Peyton, Physical Therapist, a company was formed for the pursuit of new exercise related technologies. In this pursuit, the concept of Inertial Exercise was born.

The first device used in the experimentation of Inertial Exercise was constructed in 1980. By the spring of 1983, it was clear that this concept had many applications in the health field. However, convincing the medical community of the concept’s merits was a greater effort than the group could or would muster. In the summer of 1983, Steve Davison and his company, Engineering Marketing Associates, assumed the sole responsibility of developing this important new technology.

By late summer 1984, clinical trials and experiments were completed, and the development of a durable medical product was complete. From 1984 to 1987, the Inertial Exercise System was generally accepted as a high performance-training device and was quickly accepted by trainers at many high performance athletic organizations. During this time, therapists utilized it only during the final phases of treatment, when patients were near release from service. Feedback from therapists using the device with patients helped to develop training techniques and pointed to a new philosophy in the application of the technology. Strength, power, range of motion, and compliance to pain all became treatable with this new philosophy. With the use of gravity free inertia as an instrument, neuromuscular education was the reward. Training technique of motion became the goal. Thus the instrument inherited the name Impulse Inertial Exercise Trainer. It became obvious that the device was an instrument. The more experience one has with the device the greater a variety of patients could be served by it.

Presently, the Impulse is used in the treatment of everything from coordination maintenance of high performance major league baseball pitchers to reeducation of motion for long term care geriatric patients. Although the Impulse is an excellent instrument for the continued reeducation of coordination, the philosophy and approach to training indicates other devices, already in use, can be utilized as Inertial Exercise tools. After all, Inertial Exercise is the application of inertia as the sole resistive medium in exercise.
General Principles Utilizing the Impulse

Controlling inertia requires constant acceleration and deceleration, which is, as you know, difficult if not impossible to train with manual manipulative techniques.

_The Impulse slows down the functional control of acceleration and deceleration so that the therapist can now teach the patient movement patterns while learning to accommodate pain or lack of ROM._

The movement is slowed by the inertial input of the weight (mass) moving on the gravity free track. With combined input from the therapist and inertia, control of movement is easily learned; in other words, motor programming is developed.

As a machine, its operation is very simplistic. A sled glides horizontally along a track with extremely low friction. Attached to the sled is a rope, which is guided along a system of pulleys and can then be pulled by the user. In the pulley route, a configuration of pulleys are placed below and centered on the track. When a user pulls the rope, the sled accelerates along the track (free of gravity relative to the user). When it passes the center pulleys, the direction of motion of the rope is reversed and the user will receive a pulling energy in the rope equal to the inertia created by the acceleration of the sled. In this way, the user generates all of the forces concerned in the exercise. As an instrument, the Impulse offers the ability to quickly train coordination. This means the development of motor programs.

_Hands on training with the patient and an Impulse is the quickest way to develop a functional motor program._

You, as the trainer/therapist, must understand the technique of motion that you are attempting to train. By connecting the patient to the Impulse with the appropriate attachment, and then performing the exercise yourself (with the patient feeling and following your motion) with the correct technique and intensity (at a level of performance you believe the patient can perform), the patient will immediately understand the motion you are conveying. No amount of verbal description can match this experience of feeling the motion.
Two fundamental techniques of motion can be utilized in training users with the Impulse. **Tonic**, which trains synergistic co-activation of agonist and antagonists; and **phasic**, which trains high acceleration contraction and relaxation. With the tonic technique the user maintains tension on the rope during the entire exercise session. The user is therefore proprioceptively engaged with the moving sled at all times. With the phasic technique, the user disengages from the sled at the end of each cycle. Therefore, re-engagement of the sled requires an anticipatory preprogrammed motor program to enact smooth control. Each technique utilizes mechano-receptors proprioceptively tracking the force of inertia and motion of the body to build confidence in better functional motion.

As the two waveform charts demonstrate here, the forces created by the body with each technique are radically different. And so, the control of each technique is different. Regardless of the technique used, it is the changing state of inertia in the exercise, which influences the development of motor programs. Inertia outside the body stimulates functional proprioception in the patient as well as the training therapist. The therapist, possessing a functional motor program, assists control by actively doing the movement pattern with the patient. As the therapist teaches the motion (slow motion mode or 15+ pounds), the patient senses proprioceptive input from both the therapist's motion and the inertia of the weight. When input from the therapist is removed, the patient having gained the proprioceptive awareness of inertia is able to control movement independently.

The weight is then reduced, increasing acceleration, allowing for development of actual functional high-speed activity. This is done in a matter of a few minutes, and in many cases, a few seconds. Functional levels of control can be trained even with chronic pain, limited ROM, or edema.

The more you practice training techniques with the Impulse the better you orchestrate it with your practice. When you first pick up a musical instrument, an instructor teaches you a few cords or notes; then, with practice and use you can play a very difficult piece. With the Impulse, at first, you may only have the knowledge and ability to treat problems such as rotator cuff impingement or ACL arthroscopic repair. Then, with time and experience, you may develop the ability to treat anything from head injury, stroke, or even RSDS.

The Impulse utilizes high frequency (repetition/second) low resistance exercise. **It does not build strength; it develops coordination.** It is rarely possible to work through an entire range of motion in the same exercise. The system is not designed with that goal in mind. The Impulse trains and exercises functional concentric and eccentric motor activities. Portions of the ROM, such as in a PNF pattern, may be broken down into segments of motion.
The Impulse is unlike traditional pulleys in that the eccentric contraction, using the phasic technique, takes place in a very short period of time (sometimes on the “catch”) and not throughout the entire ROM. This makes the eccentric contraction more functional and allows two variables of control in contrast to isotonic (resistance) or isokinetics (speed-rads/sec.). You may increase the weight, keeping the frequency rate the same, or increase the frequency rate, keeping the weight the same. Both will have the effect of increasing the total force by the equation: \[ \text{mass} \times \text{acceleration} = \text{force}. \]

Techniques utilizing the Impulse for rehabilitation are different from those used in high performance training. In general, rehabilitation techniques use a weight and frequency, which is appropriate for the disability (1 to 3 reps/second depending upon biomechanics, injury level and weight selection). In high performance training, the goal is to gradually decrease the weight on the sled (to only the sled as soon as possible) while increasing the frequency (athletes reach 3 to 6 reps/second depending on the biomechanics of the motion and weight selection).

The underlying activity utilizing concentric and eccentric contractions is that of acceleration and deceleration. As the sled is accelerated via a concentric contraction, it will continue moving at a velocity created by the acceleration phase until it is decelerated, or stopped, via an eccentric contraction (the "catch"). The concentric contraction is voluntary while the eccentric contraction is reflexive, thus training functional motion activity. Patients should be encouraged to increase their frequency rate to the highest pain free level, as soon as possible, thereby progressing their functional capabilities.

**Proper training technique is extremely important.**

At the beginning of an exercise, an inexperienced patient may attempt to accelerate the sled before it has been properly decelerated, producing a “jerky” motion. This will produce uncoordinated motion and frustrate the patient. Hands on training, by the trainer, with proper technique of an uninvolved area of the body are a must. Always initially teach the patient to use the Impulse with an uninvolved limb. This will provide the patient an experience of confidence with the instrument. When proper motive techniques are trained (1 to 2 minutes max of hands on training), motor control will become obvious and progress quickly. After training the uninvolved limb (at a level of intensity commensurate with the involved areas ability to produce force), the patient should continue the exercise for at least 30 seconds. This process is important in that it ingrains the newly learned motor programs. Coordinated cross over to any other portion of the body is generally instantaneous after this process. The involved area will now progress quickly (30 - 90 seconds from hands off training) in training.
Understanding How the Concept Works

What good is a muscle if you can’t turn it on when you need it?

The primary benefit of Inertial Exercise is training the user proper functional timing in any activity. If an individual is unable to perform a task requiring a given level of coordination, you may easily train the learning ability by changing the weight on the sled. The intent of the process is to train the timing of an activity, not necessarily the intensity of an activity. Intensity of the actual activity can be trained as the patient progressively improves. The following motion/force waveform analysis charts may help to demonstrate the process.

This is the waveform of a professional major league baseball pitcher (a Cy Young Award Winner) after rehabilitation. Prior to rehabilitation, the patient was diagnosed with a denervated right infraspinatus muscle from suprascapular nerve neuritis with status post surgical nerve decompression. He suffered from weakness at all elevation movements and required protection of the right arm during most activities of daily living. This patient was extremely motivated to return to work.

The motion recorded here is external rotation of the right shoulder—shoulder in neutral, elbow at ninety degrees, from forty-five degrees internal rotation to forty-five degrees external rotation. The large downward spike is the eccentric decelerating activity.

Changes in motion are occurring in the 35ms range (deceleration) and the 29ms (acceleration) with a peak force of about 395 pounds.

These times are faster than we can think. In viewing these accelerometry charts the important observation is the smoothness of the G Force line and the timing of deceleration and acceleration. This waveform is typical of a high performance activity.

Training high performance activity is the objective of Inertial Exercise. Obviously, an injured patient is not able to produce the extremely high forces demonstrated in the high performance example. What the patient needs is low forces over a long period of time. In this way, the patient is able to think through the motion while developing a new motor program. This can be accomplished by increasing the mass (weight) on the sled. Low forces on a relatively high mass produce low levels of acceleration and deceleration.

In this way, the patient can learn new coordinated skills without the fear of injury. As the patient progresses with the skills of the motion, the time required to perform the skill can be changed. This is the process of developing coordination. So we start with high weights on the sled and pull with extremely low forces. Isaac Newton explained this concept with the formula: F=ma (force = mass x acceleration).
This chart demonstrates the timing involved with this concept. Because the Impulse is a gravity free training device relative to the weight on the machine, the weight is not felt; only the mass of the weight is felt. Applying a small amount of force over a long period of time produces very slow acceleration rates. The timing of motion is so slow that the patient is able to consciously feel and control the activity with assurance.

*Deceleration in this example occurred in about 112ms with acceleration at 240ms.*

This time is easily within the realm of conscious thought. As the patient becomes more confident, a natural increase in performance will be observed. When confidence in control of this large mass is evident, reduce the weight, i.e. the mass.

The fundamental concept in patient training is to begin with the tonic technique of motion. This technique does not have a “catch” phase and is therefore more simplistic in its ability to provide a smooth “feel” and control experience. It stimulates co-activation of motor synergists while providing acceleration and deceleration times, with weights of 17.5 pounds and greater, in the realm of conscious thought control. The example of timing in the chart on page 10 is an example of the timing changes that occur when using the phasic technique. If the patient does not understand the concept of the “feel” of control of a catch, then attempting training in this technique could create anxiety.

The waveform at right is complete repetitions of exercise with different weights on the sled recording the forces produced during each cycle. Note the force is always, regardless of the mass, in the 7 to 8 pound range. What changes is the timing. It is not until the weight on the sled is 2.5 pounds and less that the timing to peak force is in the 100 ms range. If the patient can perform exercise in the tonic technique with 2.5 pounds on the sled, then performing the catch with 25 pounds on the sled in the phasic technique will require approximately the same control. When the patient learned control in tonic with 2.5 pounds, he was also learning phasic control at 25 pounds. All control is a matter of timing.
The waveforms on this page are also complete repetitions of exercise with different weights on the sled. Note the force is always, regardless of the mass, in the 18 to 22 pound range. As with the tonic technique, the timing becomes less and less as the weight on the sled is reduced. It is not until the weight on the sled is 7.5 pounds and less that the timing to peak force is less than 100 ms. This force waveform chart and the previous tonic chart demonstrate exercise intensities typical of rehabilitation. In these examples, the operator was instructed to perform as gently as possible while maintaining smooth and absolute control of the sled. These charts demonstrate the compressive effects of control as the weight of the sled changes. But we are looking at only one repetition at each sled weight. What is the relationship of repetitions per second as the sled weight changes?

The following chart offers a comparison of tonic to phasic repetitions from the same data pool the above single repetition examples were extracted.

In general, phasic exercise offers more cycles per second than tonic in intensities of user perceived comfort. The Phasic exercise offers a rest period between each cycle of work activity. Phasic produces 3+ times the force in each cycle of exercise and phasic produces deceleration times in periods much less than conscious thought is capable of regulating. The fundamental activities of each exercise cycle are acceleration and deceleration. The relationship of each activity varies from tonic to phasic and sled weight. The following charts depict these relationships.
Fundamentally, as the sled weight is reduced the timing is also reduced regardless of technique. The frequency of each cycle does not change greatly from one technique to the other respective of sled weight. However, the deceleration phase of each cycle is generally greater than the acceleration phase with the tonic technique while the relative peak force is low. The reverse is true of the phasic technique. The deceleration phase of each cycle is much less than the acceleration phase while the relative peak force is high. Note also, the acceleration time of the 7.5 pound and less sled weight, in phasic, is just on the verge of conscious human thought timing.

In this environment of exercise, the user cannot actually feel the deceleration phase as it is occurring faster than thought is possible. However, the motor program for controlling activity has been formed and is utilized from activity learned using the same techniques of motion with heavier sled weights. The user knows what to do and does not need to think about it. At this level, the deceleration phase of activity is just on the verge of conscious control. With practice, the user will gain automatic control of this sled weight and develop confidence in the ability to move in these short time periods.

Confidence is the key in training higher performance levels of human motion. This is true whether you are training motive ability with a head injury patient or higher performance levels of an Olympic athlete. Having a belief in performance attainability is the most important aspect of any exercise. The single most important ingredient in performance attainment is timing.

With Inertial Exercise, it is not the intensity of the exercise; it is the training of the timing of the activity. The selection of the technique coupled with the sled weight automatically governs the timing of the activity during the initial training phases of implementation. An experienced therapist/trainer can transition the average orthopedic type injury to 0 pound sled weight in the first training session developing confidence in motion by creating or reeducating functional motor programs. Once the user crosses the 7.5-pound sled weight, functional coordination has begun. Using heavier sled weights builds confidence in control. When confidence in control of a sled weight is evident, reduce the weight; i.e. the mass.
This is an example of the timing of deceleration in a therapeutic baseball. The player chart on page 52 is the same person in therapy. Now move with just the sled weight (3.2 pounds). Remember the max force is **18.5 pounds**. Note; however, the similarity of the shape of this chart and the chart on page 9. The deceleration phase of activity is within 36ms and much quicker than the ability of the mind to consciously control. The same may be said of the acceleration phase. With practice this patient gained control of this mass and developed confidence in the ability to move in these functional short time periods. The development of functional coordination (a motor program) has occurred.

The activity in the above chart does not require strength. The activity requires coordination.

*The power demonstrated in the chart on page 45 could only be developed if first the co-ordination required for the task is trustworthy.*

This trust in one’s ability to move is developed by repetition of task in a coordinated fashion. With this newly gained level of coordination, your patient will be more apt to utilize the injured area in daily life without fear of injury or pain.

*What good is a muscle if you can’t control it?*
Analysis of phasic exercise motion related to sled weight

Note: the sled weighs 3.2 pounds

<table>
<thead>
<tr>
<th>Weight on Sled (Pounds)</th>
<th>Travel Distance (inches)</th>
<th>Repetitions per second</th>
<th>Average power per rep</th>
<th>Approximate duration to fatigue</th>
<th>Maximum reps/session</th>
<th>Deceleration ratio to acceleration</th>
<th>High-Range Degree/Sec Shoulder Rotation</th>
<th>Stopping Time</th>
<th>Starting Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>42</td>
<td>1.43</td>
<td>106.34</td>
<td>2 min</td>
<td>85.96</td>
<td>1.70</td>
<td>1,078.76</td>
<td>0.046</td>
<td>0.108</td>
</tr>
<tr>
<td>10</td>
<td>34</td>
<td>2.91</td>
<td>410.78</td>
<td>10 sec</td>
<td>29.07</td>
<td>2.40</td>
<td>2,127.77</td>
<td>0.022</td>
<td>0.032</td>
</tr>
<tr>
<td>7.5</td>
<td>32</td>
<td>3.03</td>
<td>424.88</td>
<td>10 sec</td>
<td>30.30</td>
<td>3.33</td>
<td>2,543.69</td>
<td>0.018</td>
<td>0.028</td>
</tr>
<tr>
<td>5</td>
<td>29</td>
<td>3.62</td>
<td>425.05</td>
<td>10 sec</td>
<td>25.36</td>
<td>3.50</td>
<td>3,012.04</td>
<td>0.018</td>
<td>0.028</td>
</tr>
<tr>
<td>2.5</td>
<td>24</td>
<td>4.07</td>
<td>345.00</td>
<td>20 sec</td>
<td>81.30</td>
<td>2.00</td>
<td>1,977.74</td>
<td>0.018</td>
<td>0.026</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
<td>5.15</td>
<td>336.15</td>
<td>20 sec</td>
<td>103.09</td>
<td>1.00</td>
<td>1,617.87</td>
<td>0.018</td>
<td>0.026</td>
</tr>
</tbody>
</table>

The above chart exhibits the relationship of endurance, force, and sled weight when performing high performance phasic exercise utilizing the Impulse. The subject here is a professional football player active with a prestigious NFL team. The motion is the same for all the examples in all the charts above. That is, external rotation, shoulder in neutral at 90 degrees flexion performing 90 degrees external rotation from 45 degrees of internal rotation. The forces here are similar to those of the professional pitcher displayed earlier (page 52) with 10 pounds on the sled. Utilizing this specific motion, motor unit substitution to maintain activity was greatly reduced. In this example, the user was the most powerful in the 10 to 5 pound sled weight. Coincidentally, he exhibited the least endurance in this sled weight range. This individual was very familiar with Inertial Exercise and was asked to perform at 100% of his ability.

This example gives a demonstration of the true functional nature of Inertial Exercise. It also indicates that, when ingraining high performance activity, utilizing 5 to 7.5 pounds on the sled is appropriate. In this motion, this seems to be the weight where the human body feels good about generating the maximal torque.

It is not known but suspected that at the 2.5 and less sled weights everything is happening so fast that the user does not feel comfortable. Sensory overload may prevent the user from just letting go with everything available. Research is needed in this area as it has application to patient care as well.
Comparison of Other Exercise Device Concepts vs The Impulse

Obviously, when you compare one exercise device or concept to another, you are comparing apples to oranges. Many of these devices have the same “feel”, relative one to another, when the actual effects on the body produced by these devices are sometimes quite different. Understanding the feel of one type of exercise device, as its performance relates to another, may help the reader to understand the innate benefits derived from these devices.

What is felt, when using Inertial Exercise, is not necessarily what is actually attained. The following oscilloscopic analysis of exercise with force transducer measurement may help to demonstrate. Both force and accelerometry were measured simultaneously. Force to demonstrate the way tension on the subject is imposed and accelerometry to show the pattern of control the subject imposes on the tension.

A subject was asked to perform three exercises, the first with Elastic Tubing (3/4 Theraband blue). The subject performed at what he considered a comfortable slow rate similar to what a patient might experience.

Body mechanics are external rotation of the shoulder, shoulder in neutral elbow at 90 degrees and about 45 degrees of external rotation.

This force waveform is totally dependent on the elasticity of the tube. Some force is always applied. Maximum force per repetition is about 6.5 pounds. Each repetition is about 1.748 seconds with maximal force done in about 884ms. Note the erratic pattern of the accelerometry.

After the Elastic Tubing exercise, the subject was asked to perform Inertial Exercise using the tonic technique with 17.5 pounds on the sled. He was asked to apply approximately the same force and feel as was applied to the Elastic Tubing.

This force waveform is dependent on the acceleration rate of the weight on the sled (mass). Maximum force per repetition is also about 6.5 pounds.

Each repetition is about 1.66 seconds with maximal force done in about 828ms. The timing is almost identical to the elastic tubing, but the shape of the force curve and accelerometry are entirely different than the tonic example. Apparently, more is going on in the control of the acceleration and deceleration than the subject can feel. This is functional co-ordination. Note the smooth control of the accelerometry and its rhythmic relationship to the forces generated.
The third exercise was performed with Inertial Exercise using the *phasic technique* with 17.5 pounds on the sled. Again, the subject was asked to apply approximately the same force “feel” as with the previously performed exercises. The results were not what the subject expected.

This force waveform is dependent on the control of the reflex catch mechanism versus the attack velocity of the sled weight (mass) from the previous repetition. *Force per repetition is about 18 pounds with each repetition at about 360ms.* However, *maximal force is done in about 56ms.* A time frame that is possibly less than conscious thought can control. The subject was attempting to produce the feel of about 6 pounds of force or what he experienced with the tonic exercise. In fact, almost three times that force was produced. Note the smooth control of the accelerometry and its rhythmic relationship to the forces generated.

Compare the waveforms of phasic Inertial Exercise with this example of the same motion performed on a wall pulley weight stack machine.

The force is governed by the intensity of the exercise versus the effects of gravity on the 10-pound weight. However, once the force exceeds 10 pounds the weight begins to accelerate vertically. *Force per repetition is about 14 pounds with each repetition at about 1.45 seconds.* However, *maximal force is done in about 280ms.* Here also, there is a rhythmic relationship between accelerometry and the forces produced.

Rubber tubing and weight stack equipment have a similar goal in that they are generally used for developing strength. The accelerometry of each device indicates greater motor program control with the weight stack than the elastic tubing. The wave analysis of the Inertial Exercise examples demonstrates similar or superior forces than those exhibited in the elastic band or pulley system. These forces were created in much less time with less apparent control variance.

The greater forces are a result of functional coordination as is the lower control variance. Functional control requires the development of motor programs that maximize the efficiency of motor units performing a task. This requires anticipatory timing. Training anticipatory timing is what Inertial Exercise is all about.
Real Time Events

In the real world, many of the forces we generate (when we are in control of our motion) are so natural and occur so fast that we don't appreciate their significance. The following are samples of measurements of activities we do every day. The significant number is the time it takes to generate the force. *In the real world, if we are unable to generate this kind of force in this time frame, no work will be done.*

At the left is picking up a plastic **5-pound** grocery bag off of the floor. It is **38 ms** from zero to peak force.

At the right is picking up a **15-pound** plastic grocery bag from the floor. It is **86 ms** to peak force in this example.

Look left and see what happens when you open the refrigerator door and the magnet seal strip finally let's go. The strip lets go here in **28 ms**.

Ever had a heavy swinging glass door accidentally shut on you? From the time contact is made with the door to control of the door is **58 ms**.

In the case of the refrigerator door and the 5-pound grocery sack the peak force was created faster than neural processing is possible. With the glass door and the 15-pound grocery sack, the timing was faster than reflex motor response was possible. As each of these events and others occur in our lives, we respond with various times. The important thing is that we have confidence to respond. This confidence is due to our innate knowledge of how we are able to proprioceptively respond to actions in our realm of space. Your level of performance is based on your confidence in your ability to respond reflexively. *Building motor programs, which confirm, in the body, an ability to react to forces and actions faster than conscious thought, is building confidence.* Maximizing the body's awareness of its electro-mechanical capabilities is the goal of Inertial Exercise. After all, our bodies were made to control inertia, not to be its slave.
Operation of the Impulse

Exercises and Exercise Positioning: Regardless of the exercise application (rehabilitation or general conditioning), the following factors must be considered in order to maximize the benefits of inertial exercise:

**Pull Line Apparatus:** With each of the exercises contained in this manual, the pull line apparatus appropriate for the exercise is specified and appropriately depicted. (ankle strap, line handle or sport handle).

**Adjustment Height of the Vertical Pulley:** Each exercise depicts a view of the exercise position relative to the post assembly. The Vertical Adjustment Pulley position is recommended for each exercise. Use an anatomical landmark on the user to determine and record exercise positions. The example at left depicts the pulley position **level** with the elbow. Exact positioning of the pulley is not necessary. However, you should be within 2" up or down from the position depicted in each exercise figure. The approximate relationship of the pulley to the individual performing an exercise is important. Many of the exercises in this manual can be performed while sitting rather than standing as shown. If the exercise is performed while sitting, the pulley must be adjusted so that the relationship of the pulley to the exercise motion remains approximately the same (i.e., **level** with the elbow).

**Body Orientation to the Direction of Line Travel:** Each exercise figure depicts the relationship of the exercise motion relative to the direction of travel of the pull line. The exact position for each exercise will need adjustment according to the requirements of each individual. It is important that body positioning be in the proper work envelope relative to the force line (see above). Note the positions of the feet in the example above are depicted perpendicular to the line travel. Other exercises will depict feet position at 45 degrees to line travel or parallel to line travel.

The distance of the body from the post will vary according to the demands of each exercise. When the exercise technique is tonic, position the patient such that when the object limb is at the desired end of ROM the sled will be centered on the return pulley. If the exercise technique is phasic, then position the patient closer (3" to 6") to the pulley so as to allow for the creation of slack in the travel line during each exercise repetition.

**Weight on the Travel Sled:** Generally, this is specified with each figure for each exercise. However, if you desire higher acceleration rates than comfortably available with the weight specified remove weight as needed.

**Range of Motion:** A sled motion of 12 to 24 inches from either side of the return block is generally all the range of motion needed for any exercise. This range of motion is dictated by the distance of the individual from the post assembly and the motions involved in each exercise. Each exercise figure depicts the respective recommended ROM. This ROM may need adjustment relative to the specific needs of each patient. With these criteria in mind, range of motion will be correct.

**Rate of Acceleration:** Generally, acceleration that produces a repetition rate of 1 rep per second is excellent for introduction to therapy. The exercise objective is to increase performance relative to acceleration and deceleration. Increase acceleration only to levels that are comfortable during acceleration, return motion, and deceleration phases. **Smooth repetitious motion is far more important** than the velocities achieved during the acceleration phase. General conditioning exercises should employ an acceleration rate that produces smooth repetitious motion. One to two repetitions per second are all that is required for a proper workout. However three to four repetitions per second is common in therapy. This aspect should be dictated by the patient’s safe competence.
**Number of Repetitions:** Normally, 30 repetitions for any exercise motion are all that is required for a proper workout (rehabilitation or general conditioning) when initially introduced to the system. After the user has become proficient with control of the system, progress to three 30-second bouts with a one-minute rest of the involved muscle group between bouts. The benefits of each exercise motion are achieved through the practiced control and intensity of exercise, not the number of repetitions. Concentrate on producing a smooth repetitious flow of motion with each cycle. Overexertion and extended duration of exercise (through excessive repetitions) is potentially dangerous and can cause injury. Increase beyond 30 repetitions per exercise to the 30-second rule only if you experience none of the effects of fatigue using high acceleration rates (2 reps per second and greater).

**Degree of Coordination:** Typically, if one lacks the degree of coordination necessary to perform an exercise with the amount of weight specified, weight should be added and the rate of acceleration decreased. Concentrate on smooth control.

**Patient Training Techniques**

Getting the “feel” of Inertial Exercise is essential in maximizing patient progress. This feel is the result of smooth coordinated repetitious acceleration and deceleration of weight on the travel sled. A transition from one phase to another can be easily learned with little practice if the concept of smooth motion is adhered to. The velocity of the travel sled is not important; the smooth control of travel repetition is. While training a patient, if any anxiety begins to manifest, simply add weight to the sled regardless of the technique of motion involved. This assists in reinforcing the smooth flow “feel”.

**Patient precautions**

- Prior to using this equipment for injury rehabilitation, inflammation and pain should be controlled.
- The patient should experience no pain during the exercise.
- A physical therapist, physician, or professional trainer should supervise the patient while using equipment.
- Use of the Impulse increases the core temperature of muscle holistically. Cooling processes of the body can cause dehydration. The patient should consume a cup of water prior to exercise if dehydration is a concern.

All of the exercise techniques incorporated in the use of the Impulse consist of reciprocally pulling on a line, causing a sled to accelerate and decelerate in a horizontal plane along a track. The motion is restricted to a predetermined ROM. Both the start of acceleration and end of deceleration occur at the Initial Position (IP) of ROM. The End Position (EP) of ROM is the end of the acceleration portion of the exercise. The exercise technique determines when the eccentric component of deceleration begins, at the ROM EP or ROM IP. Selection of IP is determined by the biomechanical deficiency of the user. The IP should be in the area of ROM at which the user would need to expend maximal available energy related to conditions in the biomechanical area being developed. Three basic exercise techniques may be incorporated in the use of the Impulse. They are:

**Passive Phasic (catch waiting).** The user pulls the line through the ROM accelerating the sled. At the EP, (which is just prior to the sled reaching the center of the track) the user returns to the IP quickly, producing slack in the line, allowing the sled to coast along the track. At the IP, the user waits until the slack comes out of the line, producing a slight jerk, catching the momentum of the sled and bringing it to a halt. Thus ends one repetition and the next begins. This technique develops a sense of catch anticipation. When employed with 20 or more pounds, it can be beneficial in training ballistic inhibition and developing gait.
**Active Phasic (catch anticipation)** The user pulls the line through the ROM accelerating the sled. At EP, the user returns to the IP quickly, producing slack in the line. While the sled coasts, the user anticipates the catch and accelerates the limb into the momentum of the sled. This anticipatory act will halt the sled and create a prestretch condition in the biomechanical components. The result is an automatic transition into an acceleration phase initiating the next repetition. This technique develops motor skills where instantaneous muscle synergism is needed. It is beneficial in developing functional eccentric reflex actions fundamental in protecting injured areas; furthermore, it develops high proprioceptive skills typically called for in sport or industrial activity. By varying the activation technique, one may produce extremely low or extremely high forces. It is an excellent exercise technique for joints that are typically tight.

**Tonic** The user pulls the line through the ROM to the EP, accelerating the sled. At the EP, the user continues to attempt acceleration of the sled. When the user feels the momentum of the sled pulling on the line, he decelerates the sled proprioceptive tracking it throughout the return to the IP. At IP, deceleration forces are converted to acceleration forces for the next repetition. This technique develops motor program skills where continuous muscle co-activation through out ROM is needed. It is beneficial in developing protective motor programs that will maximize the efficient co-contractive use of an injured area. Applied properly it can increase ROM and reduce pain. It is an excellent exercise technique for joints that are typically loose or prone to sublux.

Initially, in the orientation process, train an uninvolved area of the body before treating the involved area. Remember to use a hands-on approach. As an example, train the left arm in external rotation at an intensity of operation which you estimate the injured right arm can comply with. Allow the left arm to exercise independent of your hands-on assistance giving verbal correction to insure the learning of the intensity required of the injury. Once control is obvious, switch to the injured area and continue exercise. It is not absolutely necessary to train an uninvolved upper extremity before treating the upper extremity. The user will find a substantial neurological overflow to all the areas of the body after training in only one area. The emphasis should always be on training control.

**Training**

The most successful method in training a user is the hands-on approach. Remember, train an uninvolved area of the body in both the technique and intensity of exercise you expect the involved area to do. For example, the injured area may be a knee; so start by training the shoulder in external rotation. This training technique works with all three exercise methods. The post pulley should be positioned at the height of the user’s elbow, user standing. The shoulder is in the neutral position, elbow in a flexion of 90° with the maximal eccentric component (initial position) of the exercise beginning at a forearm perpendicular to the chest position. The user should be placed such that in EP the line is pulled tight with the sled centered and the hips and feet parallel to the line. ROM should be from 30° to 45° of external rotation.
Progress in the training method as follows:

1. Place 17 ½ pounds or more on the Impulse sled.
2. Demonstrate the exercise.
3. Place the user in the appropriate starting position.
4. Instruct the user to watch your eyes or some object behind you. Caution the user not to watch the sled or the line handle during the exercise.
5. Place the line handle in the user’s hand.
6. Grasp the hand of the user and instruct complete relaxation of the limb. Do not progress until you have gained the confidence of the user, and your assessment of the limb’s motor activity is that of complete relaxation. You must be in complete control. Like the lead in a dance couple.
7. Begin the exercise with what you consider an easy comfortable intensity being aware that all motor activity is performed by you. If, through sensory feedback between hands, motor activity is performed by the user, caution the user to relax and let you do all the motor activities. Be sure the user is not watching the sled or line handle motion.
8. After about ten relaxed and instructor controlled repetitions, ask the user to initiate input into the exercise by tracking your motions with his hands. If the user seems uncoordinated, continue exercising by over powering the uncoordinated condition. Ask the user to relax while exercising and just track your motions. Tracking should occur in about ten reps.
9. When accompanied tracking is easy, ask the user to take control of the exercise.
   Make motion corrections through instructor motion tracking when required.
10. When sensory feedback indicates user control of the exercise, remove your hand while asking the user to continue the exercise.
11. Place close attention to the exercise motion being performed. Look for:
   11.1 Improper range of motion
   11.2 Improper EP positioning in ROM
   11.3 Abnormal muscle tension
   11.4 Retarded return motion
   11.5 User observance of sled or line handle. Make the appropriate verbal corrections.
   11.6 Improper motion technique (slack or no slack application)
12. If the user’s coordination begins to “fall apart” grasp his hand and begin tracking assistance. When proper motor control returns, release your hand.
13. Ask the user to perform 30 repetitions without assistance.

After the user gains coordination with the device, select any motion for the trained extremity that does not require the use of the already fatigued muscles (example - a curl motion at 90° flexion). Ask the user to exercise. Increase the intensity of the exercise. After a few reps, do the exercise with the smallest intensity possible. If in performing this, the user has difficulty controlling the sled, add five pounds to the sled and continue the exercise. When the control of motion is regained, reduce weight in five-pound increments each time allowing the control of motion to “set in”.

When proficient in low intensity motion, adjust the Impulse for exercises of the involved area. Exercise the involved area. Initial exercise bouts should be 30 reps for each needed plane of motion of the involved area including the exercise specific to the injury. For subsequent exercise sessions, when the user can perform 2 or more reps per second, change the exercise bouts to 30 seconds.
Utilization in Rehabilitation

The examples described below are specific to the area of the body in question. They are offered as examples of how and what to do but are not written in stone.

General Shoulder Program

This program can be used to initiate rehabilitation associated with most shoulder problems. It can be modified for specific problems; for example, a chronic dislocation shoulder may want to focus more on shoulder internal rotation and adduction than external rotation and abduction, or a rotator cuff tendonitis may need to back off external rotation exercises until pain diminishes, but should be able to perform most other motions.

Position - Neutral
Sled Weight- 10 pounds
Line Attachment - Line Handle
Motions- Extension, Flexion
                   Internal rotation
                   External rotation (in 20° - 30° abduction)
                   Adduction (45° to 10°)
                   Abduction (10° to 45°)

If the patient has difficulty coordinating the movement, increase or decrease the weight until he can perform it in a coordinated fashion. This may be different for each of the shoulder patterns, again depending upon pathology. The frequency should be a comfortable rate for the patient. He will usually choose the frequency rate most appropriate for the shoulder pattern. For example, shoulder adduction will be easier in most cases than external rotation and most patients will automatically increase the frequency on this exercise, thereby increasing the resultant force.

Begin the first day with one set of 30 at a tolerable frequency. Then progress to 3 sets of 30 reps or to 3 sets of 30 seconds, again at a tolerable frequency. As the patient progresses, increase the force by increasing the frequency of the exercise, or increase the weight (1¼ pounds to 2½ pounds increments) if for any reason the frequency should not increase.

Specific Problems Upper Extremities

Chronic Shoulder Dislocation/Post Reconstruction
You can work through a very small ROM on the Impulse by utilizing only 10" to 18" of sled travel from either side of the central pulleys. This makes it possible to achieve relatively high forces while working through a very small ROM as in a dislocating shoulder. Working shoulder adduction and internal rotation can be done quite successfully early on in the rehabilitation of an anterior inferior dislocation or ER and abduction in a posterior dislocation. Using short quick tonic movements on the Impulse causes reflexive co-contraction about the shoulder and works quite well in multi-directional instabilities. As he progresses, the patient can be moved into more functional positions depending upon lifestyle and goals.

Impingement/Rotator Cuff Tendonitis  Attachment - Line Handle
These work quite well with the general program. The patient will more than likely need to drop down on weight or frequency in external rotation depending upon the stage of inflammation. He may also be progressed to the "Empty Can" position for isolation of the supraspinatus.
**Adhesive Capsulitus**  Attachment - Line Handle
The Impulse works quite well as an adjunct to heat, mobilization, and other therapies for frozen shoulder. Generally the condition will respond to high weights (25 pounds) and slow movements for extension, using the full length of the track performing repetitions until fatigue. Other motions follow the general protocol with caution to underlying pathology (i.e. tendonitis, bursitis, fracture, etc.)

**Arthritis - OA - RA**  Attachment - Line Handle (upper extremities) ankle strap (lower extremities)
Arthritis patients do particularly well in post-acute phases because no weights are being lifted against gravity causing joint compression for long periods of time. Five pounds of weight at a frequency rate comfortable for the patient is usually adequate although, occasionally ER and abduction need to be reduced to 2½ pounds. A frequency rate of one set of 30 reps is most appropriate.

**Tennis Elbow Medial or Lateral**  Line Attachment - Line Handle
Elbow Extension - 10 Pounds
Elbow Flexion - 10 Pounds
Wrist Extension - 10 Pounds (Male); 5 to 7½ pounds (Female)
Wrist Flexion - 10 Pounds (male); 5 to 7½ pounds (Female)

**Wrist Sprain**  Line Attachment - Sport Handle
Pronation - 10 Pounds (Male); 5 to 7½ pounds (Female)
Supination - 10 Pounds (Male); 5 to 7½ pounds (Female)
Ulnar Deviation - 10 Pounds (Male); 5 to 7½ pounds (Female)
Radial Deviation - 10 Pounds (Male); 5 to 7½ pounds (Female)

Begin with one set of 30 reps and progress to 3 sets of 30 seconds. If these patterns are difficult to isolate or are painful, they can be incorporated into part of a shoulder pattern, such as shoulder extension with wrist extension or internal rotation with wrist flexion or pronation.

**Specific Problems Lower Extremities**

**Quadriceps Strain**  Line Attachment - Ankle Strap around Ankle
Knee Extension - Seated - 17½ Pounds - catch at 90°
Knee Flexion - Seated - 17½ Pounds - catch at 90°
Hip Flexion - Standing - 17½ Pounds- catch at 0°
Hip Adduction - Standing - 15 Pounds - catch at 0°
Hip Abduction - Standing - 15 Pounds - catch at 0°
Hip Flexion with Knee Extension (kicking motion) - Standing - 15  Pounds catch at less the 30°

Progress to 3 sets of 30 reps or 30 seconds, decreasing weight by 5 pounds increments until there is no weight on the sled.

**Hamstring Strain**  Line Attachment - Ankle Strap around Ankle
Knee Extension - Seated - 17½ Pounds
Knee Flexion - Seated - 17½ Pounds
Knee Flexion - Standing - 15 Pounds
Hip Adduction - Standing - 15 Pounds
Hip Abduction - Standing - 15 Pounds
Hip Extension with Knee Extension - Standing - 15

Progress to 3 sets of 30 reps or 30 seconds, decreasing weight by 5 pound increments until there is no weight on the sled. Hamstrings are primarily fast twitch fiber and need to be rehabilitated at a high performance rate for best results. Patients will usually progress down in weight quickly on this one.
Post-Surgical Cases  Line Attachment - Ankle Strap around Ankle
Protocol will depend on what was done in surgery and the current stability/state of the knee joint. Any of
the above patterns may be done depending upon the surgery, etc. One additional activity that can
usually be done early on is to work on coordination and balance by attaching the ankle strap to the
uninvolved leg, weight bearing on the involved leg (a partial support such as a walker or chair may be
necessary), and performing leg and hip activities on the involved leg. This forces balance on the involved
extremity.

Ankle Sprains  Line Attachment - Ankle Strap around Foot per Specification.

Ankle Dorsi-flexion - Seated, knee at 45° ankle level with hip (use stool for foot) - 7½ to 10 pounds. Link
at bottom of foot with rope going away from body (facing post).

Ankle Plantars-flexion - Seated, knee at 45° ankle level with hip (use stool for foot) - 10 to 15 pounds.
Link at top of foot with rope going towards body (back to post).

Ankle Inversion - Seated, knee at 45 to 90°, ankle at floor level - 7½ to 10 pounds. Link at instep
(abductor hallucis) with rope going under foot to post, foot at 90° to rope. Hip internal rotation may be
useful as the acceleration motivator.

Ankle Eversion - Seated, knee at 45 to 90° ankle at floor level - 7½ to 10 pounds. Link at outstep
(abductor minim digiti) with rope going under foot to post, foot at 90° to rope. Hip external rotation may
be useful as the acceleration motivator.

Combination hip abduction with eversion - Standing - 7½ to 10 pounds. Link at outstep (abductor minim
digiti) with rope going under foot to post, foot at 90° to rope.

Combination hip adduction with inversion - Standing - 7½ to 10 pounds. Link at instep (abductor
halluces) with rope going under foot to post, foot at 90° to rope.

Ankle sprains respond quite well to the Impulse because it retrains the peroneals to react quickly when
the ankle is challenged. Progress to 3 sets of 30 reps or 30 seconds. Progress down in weight and up in
frequency rate as quickly as possible.
2006 **Shoulder rehabilitation: non-operative treatment** - Todd Ellenbecker—2006
http://www.amazon.com/Shoulder-Rehabilitation-Non-Operative-Todd-Ellenbecker/dp/1588903702

2004 **Therapeutic Exercise: Moving Toward Function** - Hall CM, Brody LT, eds. Baltimore, MD 212001-2436, Lippincott Williams & Wilkins, 2004
This is an excellent all around manual for the physical therapy student or clinician. It concisely and effectively covers all of the major areas of orthopedics with a review of neurological and musculoskeletal function and injuries. Hall uses well layed-out diagrams to provide a basis for diagnosis and then treatment with therapeutic exercise. This book is a great reference to add to your book shelf.
http://www.thefreelibrary.com/Therapeutic+Exercise:+Moving+Toward+Function-a059079139

"Impulse...is capable of hitting the conditioning and rehabilitation ball out of the traditional training ball park"
"a major breakthrough in training on field power in the weight room"
"Some of the benifits you can expect to gain from using inertial impulse training include the duplication of on-field forces, functional strength and power gains that are transferable to competition in your sport, stronger tendons and ligaments, and a reduction in training time.

Chapter 32: Trunk and Lower Extremity Strengthening for Football, Robert Ward
"Impulse... improving coordinated action of the trunk and legs justify its being given a high-level priority for inclusion in the training facility."
*Dr. Ward discusses quickly how the Impulse is absolutely functional in the kinds of training it does and how that function, with the Impulse, directly effects performance on the field.*
Research from studies at the Dallas Cowboys documents high forces (425 foot pounds per rep) generated with various weight on the sled. Duration to fatigue under these high forces is also documented.

1992 **Eccentric Muscle Training in Sports and Orthopaedics** - Mark Albert & Bruce, Brownstein Medical Textbook
"Versatile clinical protocols can be safely applied in a time efficient manner with minimal requirements for the trainer, therapist supervision." (point 4 on pg. 91 of the conclusion section)
*The general idea of this chapter is the Impulse can be used on all points of the body. Three case studies demonstrate that clearly you get a really good level of achievement for clinical results for various types of problems. All of these solutions are backed up with scientific research, protocols, and scientific documentation from our research equipment.
http://www.thefreelibrary.com/Eccentric+Muscle+Training+in+Sports+and+Orthopaedics-a011873061

1989 **Power, A Scientific Approach** - Frederick C. Hatfield, Ph.D., Contemporary Books, 1989
"One of the most amazing concepts for sports training I've ever come across."
"You can simulate any sports skill requiring ballistic force"
"I bought two of them so I can do both sides simultaneously"
"With Impulse Inertial Exercise you can isolate any muscle or muscle group and you can simulate any sports skill requiring ballistic force, that's something you can't do with a dumb bell or bar bell in any consistent manner"
http://www.amazon.com/Power-Frederick-C-Hatfield/dp/0809244330
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Impact PPS APTA, Pam Buttram, DPT, March 2007

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Steven W Davison, February 2007  

2006  **The Purpose of Position**  
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[http://www.inno-sport.net/The%20Purpose%20of%20Position.htm](http://www.inno-sport.net/The%20Purpose%20of%20Position.htm)

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2003  **Analysis of Kinematics and Contraction Characteristics on Impulse Inertial Exercise System with Different of Exercise Loads and Shuttle Distances**  

2002  **Play Ball!** Donald E Tepper, PT Magazine’s for Your Health  
Supplement to PT Magazine of Physical Therapy-2002 pgs 6-7

1998  **Pure Magic** – Roy D Kurban  
Black Belt, Issue 01043-February 1998, pgs 64-70

1991  **Inertial Loading Principles Added to Rehab Techniques/Equipment**  
ADVANCE for Physical Therapist  
Michelle P. Pronsati, August 26, 1991

"In terms of research ....what we have learned indicates that this is a very neuromuscular kind of training unit".  "Weight of more than 30lbs is used rarely with Inertial Exercise (the Impulse) he cautioned the only time I would do that is if I was training the spine and I would then use between 25lbs and 35lbs. Admittedly these are some guide lines that need additional research, but they seem to work safely & well in the clinic." *Review of Mark Albert's presentation to the NATA. This is the first quote by somebody before any Inertial Exercise research existed. (The first quote the better of the two.)

- the statement coincides with exactly what we have been promoting for the last 22 years on this concept,
  - that it is neuromuscular and that it builds power and works very well with backs as long as you use heavy weights


"The inertial unit is an excellent exercise modality for eccentric work. By utilizing various function patterns the extremities are strengthen in an eccentric mode. Coordination and timing are additional factors that may be improved upon with this interval work out." (pg. 12)

*They speak of it as a factual modality, to them it is just another device to train with.


Our case report details the effects of workouts done on a novel low-friction inertial exercise trainer (IET; Impulse Training Systems, Newnan GA) over a 140-day period by a young baseball player to improve his pitch velocity. Workouts entailed 32 exercises each performed by the right, and then followed by the left, sides of the body against 3.4 kg of added mass to the IET three times per week. Approximately every two weeks the subject's performance was measured with two tests. One test assessed pitch velocity with a standard 142 g baseball and calibrated radar gun, while the second measured internal rotation force on the IET with no added mass to the device. After 140 days, test results showed large maximum internal rotation force (+338%) and pitch velocity (+28%) improvements.

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http://versita.metapress.com/content/865141w42w8q442k/fulltext.pdf


To assess blood lactate and performance variables obtained from high-speed exercise performed on a device (Impulse Training Systems; Newnan GA) that imposes loads without gravitational resistance, subjects (n = 45) completed two tonic and two phasic workouts. Each high-speed workout entailed two 60-second sets of seated knee- and hip-extension repetitions separated by a 90-second rest period. Pre- and five minutes post-exercise, lactate concentration was measured from a fingertip blood drop with a calibrated analyzer (Accusport, Sports Resource Group, Hawthorne, NY). Mean blood lactate values were compared with a 2(contractile mode: tonic, phasic) × 2(time) × 2 (gender) ANOVA, with repeated measures applied to workout mode and time. Resistance exercise performance variables were assessed with 2 (contractile mode: tonic, phasic) × 2 (gender) ANOVAs. With α 0.05, results showed a time (post > pre) effect for blood lactate. Exercise performance values were impacted by workout mode and gender, yet those independent variables had no impact on blood lactate. Results concur with prior resistance exercise studies that show significant blood lactate increases over time. Additional inquiry is warranted as to why gender and workout mode influenced resistance exercise performance variables, but did not impact blood lactate.


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A high-speed, low-resistance inertial exercise trainer (IET, Impulse Training Systems, Newnan, Ga) is increasingly employed in rehabilitative and athletic performance settings. Repetitions on an IET are done through a large range of motion because multijoint movements occur over more than one plane of motion, with no limitation on velocities or accelerations attained. The current study purpose is to assess data reproducibility from an instrumented IET through multiple test-retest measures. Data collection methods required the IET left and right halves to be fitted with a TLL-2K force transducer (Transducer Techniques, Temecula, Calif) on one of its pulleys, and an infrared position sensor (Model CX3-AP-1A, automationdirect.com) located midway on the underside of each track. Signals passed through DI-158U signal conditioners (DATAQ Instruments, Akron, Ohio) and were measured with a four-channel analog data acquisition card at 4000 Hz. To assess data reproducibility, college-age subjects (n = 45) performed four IET workouts that were spaced 1 week apart. Workouts entailed two 60-second sets of repetitive knee- and hip-extensor muscle actions as subjects were instructed to exert maximal voluntary effort. Results from multiple test-retest measures show that the IET elicited reproducible intra- and interworkout data despite the unique challenge of multiplanar and multijoint exercise done over a large range of motion. We conclude that future studies in which IET performance measurement is required may choose to instrument the device with current methodology. Current practical applications include making IET data easier to comprehend for the coaches, athletes, and health care providers who use the device.

http://journals.lww.com/nsca-jscr/Abstract/2008/11000/Performance_Evaluation_of_a_High_Speed_Inertial_7.aspx

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http://www.ingentaconnect.com/content/asma/ased/2007/00000078/00000009/art00004
2007 Instrumentation of a high-speed inertial exercise device with load cell transducers\textsuperscript{53rd}

For each workout set the following variables were recorded: peak force (PF), average force (AF), and total work (TW). To assess the degree of reproducibility of the data collected, intraclass and interclass correlation coefficient (CC) values were determined from this data. CC values are considered a means by which to assess the degree of agreement between measures (2, 5). It may be defined as the covariance between two measures divided by the total variance (4). Unlike basic correlation analyses, CC values do not discriminate by inflating the strength of agreement between paired values, or on the basis of sample size (6). CC may also be calculated in such a way as to be sensitive to systematic bias in the data (1).

RESULTS No subjects were injured from their project participation. Intra- and inter-workout CC values are shown below. Intra-workout results compared variables from within a given workout (tonic set 1 vs. tonic set 2 for example). In contrast, inter-workout values compared a given variable collected from different workouts (a tonic set 1 variable from the first workout versus the same variable obtained from tonic set 1 of the second Workout).

http://www.isa.org/Template.cfm?Section=Communities&template=/Ecommerce/ProductDisplay.cfm&ProductID=9408

2004 Concentric and Eccentric Loading Regime for Shoulder Rehabilitation, Karen P. Norton1 and Sean S. Kohles2, 1 U.S. Army Natick Soldier Center, Natick, MA; 2 Kohles Bioengineering, Portland State University, and Oregon Health & Science University, Portland, OR. Volume 221, Number 3 The shoulder joint mechanics of the impulse inertial exercise have been successfully quantified. The results of this study will aid therapists in the monitoring of patient rehabilitation by providing them with the essential force and moment information.

http://journals.pepublishing.com/content/m4x64274361n4250/

2003 Functional effects of inertial training of the upper extremity - Journal of Sport Rehabilitation, McLoda, Todd A., Murphy, Kate M., Davison, Steve, 1056-6716

A study conducted to determine the effects of inertial training on selected functional components of throwing is discussed. A device called Impulse Inertial Trainer that was selected for the inertial training revealed that for experienced throwers, functional measures and muscle activity were not affected by inertial training of the upper extremity.


This paper compares the Impulse to other forms of strength training such as free weights, isokinetics and theraband much like the previous papers. However, this paper tests the lower extremities rather than the upper extremities. EMG analysis was the main interest, however strength gains were measured. The results were similar to previous research in that the Impulse outperformed the other training devices and techniques in both strength gains and EMG activity.


Rehabilitation and training of the shoulder in throwing and overhead athletes has dramatically changed during the last decade. Athletes are returning to participation in overhead sports faster than ever. There are numerous reasons for this rapid return to athletic training or competition. These reasons include increased anatomic understanding of the shoulder complex, increased understanding of the biomechanics that occur at the shoulder complex in sports, and ability to integrate this new knowledge into performance enhancement. In addition, a better understanding of the scientific and clinical concepts of plyometrics has facilitated this improvement in performance. Although there are numerous studies regarding the application of plyometrics in the lower extremities, there are very few regarding the application of plyometrics to the upper extremities. This article describes the physiologic, biomechanical, and neurophysiological basis of upper extremity plyometrics with an emphasis on clinical application.


The data collected in this study provide objective kinematic and EMG data for elbow flexion motion during inertial exercise performed at five different loads. 1) There were significant differences between the phasic and tonic exercise technique and between different loads. 2) There was a general trend for peak angular velocity and peak platform accelerations to increase as the load decreased. 3) There was significantly greater mean and peak triceps brachii muscle activity (EMG) during the phasic exercise and significantly greater mean and peak EMG activity in the biceps brachii muscle between the loads of 9.07 kg and 0 kg. 4) Significantly greater range of motion occurred during the tonic exercise. 5) Athletic trainers using inertial exercise should therefore consider both the exercise technique and load parameters when designing protocols to meet the specific demands of their patients and athletes.

http://www.jstage.jst.go.jp/article/jpts/9/1/9_33/_article/-char/en

1995 Electromyographic Analysis of Elbow Flexion During Inertial Exercise - Journal of Athletic Training, NATA, Volume 30, Number 3, "Kinematics ", James Tracy, MS, PT, ATC, CSCS; Shuchi Obuchi, MS, PT; Ben Johnson, PhD, September 1995 This paper duplicated the Albert et.al. research with an emphasis on EMG. (The Albert paper only measured strength gains). This paper documents considerable EMG activity in several modes of muscle contraction. Again the Impulse outperformed other forms of training both in strength gains as well as EMG volume.


1995 Functional Plyometric Exercises for the Throwing Athlete - Journal of Athletic Training, David J. Pezzullo, MS, PT, ATC; David J. Pezzullo is Clinical Assistant Professor at University of Pittsburgh School of Health and Rehabilitation Sciences, Department of Physical Therapy, Pittsburgh, PA 15213. He is also a Physical Therapist IV and Athletic Trainer at University of Pittsburgh Medical Center, Center for Sports Medicine, 4601 Baum Boulevard, Pittsburgh, PA 15213. Steven Karas, MS, ATC; Steven Karas is Student Physical Therapist at Chatham College, Pittsburgh. James J Irrgang, MS, PT, ATC; James J Irrgang is Assistant Professor at University of Pittsburgh Department of Physical Therapy, Director of Outpatient Physical Therapy and Sports Medicine at University of Pittsburgh Medical Center. 30(1): 22–26
This paper reviewed the practical application of the Impulse to the throwing athlete. It chronicles the performance aspect of training as no other training device known can duplicate the functional angular velocities of inertial exercise.

https://www.researchgate.net/publication/7221625_Functional_Plyometric_Exercises_for_the_Throwing_Athlete
Inertial exercise protocols are currently used clinically to improve and restore normal muscle function even though research to substantiate their effectiveness cannot be cited in the literature. The purpose of this study was to compare simultaneous kinematic and electromyographic (EMG) data obtained from 12 subjects during elbow flexion on the Impulse Inertial Exercise System. Testing sessions consisted of inertial exercise performed using phasic and tonic techniques with loads of: a) 0 kg, b) 2.27 kg, c) 4.54 kg, d) 6.80 kg, e) 9.07 kg. Greater peak angular velocities, peak platform accelerations (change in velocity of platform during elbow flexion), mean and peak triceps brachii muscle EMG activity, and less range of motion were observed during phasic exercise. There was also a general trend for peak angular velocities and peak platform acceleration to increase as the load decreased. No significant difference in mean or peak EMG activity of the biceps brachii muscle was seen between techniques. Clinicians and athletic trainers using inertial exercise should consider both the exercise technique and load characteristics when designing protocols to meet the specific needs of patients.


1994  Muscle Torque Changes Caused by Inertial Exercise Training - JOSPT Volume 20, Number 5, ””, Mark Albert, MEd., PT, ATC; Ellen Hillegass; Peter Spiegel, November 1994
This research was the first to document superior strength gains in training with the Impulse versus other methods of training. Here inertial exercise outperformed isokinetics, theraband, and free weights as measured by isokineti. The final result measured being strength gains both eccentrically and concentrically.