In October of 2000 nearly 4000 athletes with disabilities from 122 nations converged on Sydney, Australia to compete in eighteen sports in the Summer Paralympic Games. Accompanied by 2100 coaches and support staff, athletes won 550 medals in the intense competitive arenas while more than 300 million television viewers and one million spectators watched in awe. The Games required the support of 815 technical officials and at its peak more than twenty-five percent of the athletes in Sydney competed in track and field (athletics) events which comprised just over forty percent of the total number of events in the Paralympic program.

It was just over 50 years ago that disabled sports were surfacing in veteran’s hospitals in the United States and England. In 1948, the Stoke Mandeville Hospital in Aylesbury, England held the first British competition for the lower-extremity impaired, offering wheelchair archery for sixteen spinal cord injured veterans. Four years later, in 1952, the International Stoke Mandeville Games hosted 130 participants representing two nations at the first international games for athletes with disabilities. In the United States, the mid to late 1940s saw a similar spark of opportunity for athletes with disabilities.

In 1957, wheelchair-racing competition was held at the 1st National Wheelchair Games in Hempstead, NY. A year later, the National Wheelchair Athletic Association (NWAA) was formed, which created opportunities for participation in the United States in swimming, table tennis, archery, and track and field.

Meanwhile, on the international scene, track was not introduced until 1964 in the Tokyo Paralympics. There men had the opportunity to compete in the 100 meters, while women were able to compete in the 60 meters. Limiting athletes to races 100 meters and less would be standard practice until the early 1970s. Only with the NWAA’s staging of races covering 220 yards, 440 yards, and 880 yards would a breakthrough from this limitation occur. By 1978, the International Stoke Mandeville Games Federation had followed the NWAA’s precedent and approved races covering 200 meters, 400 meters, 800 meters, and 1500 meters for the Olympiad for the Disabled.

The first Games for athletes with cerebral palsy in the United States were held in 1978 in Detroit. Track and field events were organized for athletes with all degrees of cerebral palsy. Traditional field events were offered for athletes with moderate to minimal impairment while modified field events were developed for those with more severe impairments including lower extremity events.

The late ‘70s also saw the advent of competition in track and field for athletes with visual impairment. The United States Association for Blind Athletes was formed in 1976.

The 1984 Olympic Games in Los Angeles hosted the first Olympic demonstration events for athletes with disabilities with the inclusion of the 1500m men’s and 800m women’s wheelchair finals. Since that time wheelchair track events have been included on the Olympic athletics program for both men and women, however, to date the events have been limited to “demonstration” rather than full medal status. The IAAF also regularly includes demonstration events for athletes with a variety of disabilities in its World Championship program.

Today, Paralympic track and field competition offers opportunities to a diverse disabled population, from those competing standing to those competing in wheelchairs. Former restrictions have been abolished and like their able-bodied counterparts, Paralympic track and field athletes compete in events ranging from the 100 meters to the marathon (26.2 miles); compete in javelin, discus, shot, high jump and long jump. Where possible, rules governing able-bodied track and field are kept in place. However, because some adaptations to events are necessary to ensure accessibility, rule variances do exist.
The coach of the track and field athlete with a disability must be aware of these rule differences and, equally important, must understand the unique training needs of such an athlete. The application of able-bodied training technique is often appropriate, but understanding adaptations and modifications may also be necessary.

This manual intends to give coaches a fundamental knowledge base so they are able to expand on their current experience and be able to adequately meet the unique needs of the disabled track and field athlete with a disability.

THE TRACK AND FIELD COACH

Ken Doherty, in his unparalleledTrack and Field Omnibook, samples the philosophies of track and field’s greatest coaches. Underlining each coach’s particular philosophy is a similar passion for coaching. It is a passion not only for track and field, but more importantly, it is a passion for being a positive, charismatic force in the life of the athlete. Doherty expounds on this passion while discussing Brutus Hamilton, former track and field coach at the University of California at Berkeley. Doherty writes

Brutus Hamilton was a coach of track and field but, much more, a coach of young men by way of track and field. Their personal development was his primary goal, not his personal record of success. He liked to win, was a tough competitor as an athlete and a coach. But winning was not an end in itself so much as a means of motivating the day-after-day training and anguish that lead to the primary goal of self-development. [H]is story is one of loyalty and respect for his boys and their almost mystical devotion to the man they still remember as “The Coach.” (1985, p. 1)

Hamilton did not underestimate the influence he was having on his athletes’ lives. He understood that he was in a favorable position to be a positive and empowering influence. He took full advantage of it. The coach of the athlete with a disability holds a similar opportunity, but one with more powerful ramifications. Few other sources will positively impact a disabled individual in the way that sport does. Attributes that characterize sport – independence, empowerment, self-discipline, accountability, self-confidence – directly undermine the stigmatized characteristics at times associated with people with disabilities.

As Hamilton said, if there is one guiding principle that should underscore all coaching decisions and behavior, it is this: sport is not an end in itself, but rather a means to an end. What's most important about sport is not winning an event. Most important is how sport shapes and develops the athlete. Through sport, the athlete gains self-discipline, self-worth, independence, a sense of empowerment, and expects more of him or herself. These are skills that will assist athletes in being productive members of society. It's a coach's duty to teach and reinforce these skills.

Necessary for the Paralympic track and field coach is an understanding of sport and some degree of experience in sport, preferably in track and field. It is not necessary that the coach have direct experience in competing or coaching, although either is helpful. In addition, an understanding of disability is helpful. The successful coach, however, must understand his or her areas of weakness in coaching and be eager to improve on such areas.

Overall job goal

The coach provides leadership in the ongoing development and improvement of adapted sports programming through coordination, planning, evaluation, and implementation of programs.
**Characteristic duties and responsibilities**

1) Assist in the acquisition of program sponsorship for equipment  
2) Supervise assistant coaches and volunteer staff  
3) Serve as a liaison and consultant to the community to facilitate the accommodation of individuals with disabilities within the community recreational program  
4) Develop, coordinate, and execute athletic fitness training  
5) Assist in the development of a competition schedule  
6) Coordinate and supervise travel to competitions  
7) Coordinate promotions and public relations  
8) Develop a regional volunteer base  
9) Provide service to professional organizations and societies that promote or provide leisure opportunities and services for persons with disabilities  
10) Recruit persons with disabilities living within the community or surrounding communities  
11) Direct the fitting, ordering, maintaining, and updating of disabled sports equipment  
12) Assist in the recruitment, screening, hiring, training, and assignment of coaching staff.  
13) Maintain and care for training facilities.  
14) Catalog records of team and individual accomplishments.

The athlete’s ability to learn a new skill or technique largely depends on the effectiveness of the coach’s instruction. That instruction must rely on a sound understanding of the given skill and an ability to positively reinforce the athlete during the learning process. Apprehension and fear often accompany learning a new skill, and so it’s critical that the coach help the athlete have a positive experience. An effective teaching strategy can be broken into two parts: demonstration and feedback (Publow, 1999).

**Demonstration**

One method for demonstration is “Whole-Part-Whole” sequencing. Using this method, the coach breaks down the entire range of movement into phases. Each phase is then isolated and practiced as if it was a whole movement in itself. Doing this breaks the entire range of movement into smaller, more easily understood movements, making it easier to focus on and develop the given skill. It should not be forgotten that the phases must be integrated in order for the acquisition of the skill to be successful. Therefore, the athlete should always be reminded how the phases function as an incorporated part of the whole movement.

Learning a new movement can be made easier if the athlete can draw on an already known skill that mimics the desired movement. For instance, in wheelchair racing, the athlete can mimic turning an arm crank, clapping chalk erasers, or scrubbing the bathtub.

The importance of initial learning should not be underestimated. Once integrated into the neuromuscular scheme, movement patterns are extremely difficult to retrain. To do so requires hours of repetition and reprogramming because the entire incorrect neuromuscular movement, picture, and feel has to be retrained and replaced with a new movement.

**Feedback**

Feedback immediately follows the execution of the movement. The coach must focus on what the athlete is doing correctly, explaining what changes should be made, and the positive result that will follow. Negative feedback that emphasizes what is being done incorrectly should be avoided.

The benefit of positive feedback can be traced to the “Law of Effect,” which states, “all other things being equal, the greater the feeling of satisfaction, the sharper and more related the awareness of the desired action, and the more immediate the resulting satisfaction, the more likely that response is to be repeated” (Doherty, 1985, p. 485). In other words, by associating a positive feeling with the correct movements, the athlete is more likely to master them.
Philosophy
Providing positive and safe sports experiences for America’s youth is the mission of the National Alliance for Youth Sports (NAYS) and one to which, as a partner of NAYS, BlazeSports Clubs of America (BSCA) fully aligns itself. Since being established in 1981, NAYS has certified more than 1.8 million volunteer coaches dedicated to positive youth sports. Before being initiated as a member, each coach must sign a code of ethics. The code’s pledges capture the philosophy behind NAYS’ mission and are worth considering. The following are some key pledges, each of which BSCA fully supports:

- I will treat each player as an individual, remembering the large range of emotional and physical development for the same age group.
- I will do my best to provide a safe playing situation for my players.
- I will do my best to organize practices that are fun and challenging for all my players.
- I will lead by example in demonstrating fair play and sportsmanship to all my players.
- I will provide a sports environment for my team that is free of drugs, tobacco, and alcohol, and I will refrain from their use at all youth sports events.
- I will be knowledgeable in the rules of each sport that I coach, and I will teach these rules to my players.

RECRUITING ASSISTANT COACHES

The skills required for an assistant coach are similar to those required of the head coach, but to a much lesser degree. It’s preferable that the assistant coach should have some demonstrated level of involvement in adapted athletics, but that’s not absolutely necessary. At minimum, the assistant coach should have some athletic experience, either competing or coaching. Most important is that a high degree of interest in adapted athletics exists alongside a willingness to learn from the head coach.

Individuals that possess the skills to adequately fill an assistant coaching position might include:

- therapeutic recreation specialists
- adapted physical education teachers from area schools
- physical therapists and occupation therapists
- high school coaches
- retired athletes
- youth sport coaches

Finding such individuals may take some effort on the part of the head coach. Here are some possible ways to go about it:

- Contact the given sport’s disabled sports organization (DSOs) for information on local organizations that might provide assistance.
- Contact local rehabilitation centers and get in touch with the therapeutic recreation department.
- Contact local colleges. They might have kinesiology or recreation students who need to volunteer hours in order to graduate.
- Subscribe to adapted sports magazines, which contain a wealth of information on organizations that might provide contacts and assistance.
• Contact the Paralyzed Veterans Administration (PVA) and the Department of Veterans Affairs (VA). The national headquarters can provide contacts at local headquarters, which in turn might provide potential individuals.
• Contact local prosthetists and orthotists.
• Contact local organizations such as Easter Seals Society, March of Dimes, and the United Way for local contacts.

ATHLETE PHYSICAL CHARACTERISTICS

A distinct difference between athletics and sports such as basketball is the level of emphasis placed on the individual. Certainly, there is vital team interaction in track and field, but not to the degree as in basketball. In that respect, athletes interested in competing in track and field have a tendency to be independent and enjoy that component of individuality. These athletes enjoy training that focuses primarily on personal development rather than on team development. In competition, they are willing to accept the full responsibility of performance results.

Track and field athletes must have an acceptable level of coordination and balance skills to allow them to throw, run, or push (a racing wheelchair). These skills are essential in developing and using appropriate technique.

From this general characterization of a track and field athlete, specific physical attributes that lend themselves to successful participation can be identified for each sport. The attributes listed are a broad stroke and do not reflect possible physical limitations due to disability.

Throws
• a wide to moderate shoulder width
• strong abdominal and back muscles
• good agility
• large hands and strong arms
• a high level of strength

Ambulatory Sprinters
• strong upper leg, abdominal, and back muscles
• good reaction skills
• ability to create a high power output
• a high percentage of fast twitch muscle fibers

Ambulatory Endurance
• a low body fat percentage
• a high percentage of slow twitch muscle fibers
• good heart and lung development

Wheelchair Track
• a high strength to weight ratio
• wide shoulder width
• long arms and torso
• good hand speed

Jumps
• tall with long limbs
• strong upper leg, abdominal, and back muscles
• good reaction skills
• ability to create a high power output
• a high percentage of fast twitch muscle fibers
THE FACILITY

Track

*Wheelchair Track Athletes*
Most common track surfaces can be used without hazard to its surface or the athlete's safety, with the exception being cinder. Extra caution should be used, however, when training on an asphalt track. Its surface has very little cushion so crashes can be more dangerous. At the same time, because asphalt offers low rolling resistance, higher speeds than normal can be reached. The coach must therefore emphasize chair control and awareness of where other athletes are on the track.

It is recommended that training be done early morning or late evening on tracks besides asphalt during hot weather. Extreme heat softens their surfaces and dramatically increases rolling resistance, making pushing more difficult (Morse, Hedrick, Hedrick, Figoni, & Little, 1995).

On any track venue, it’s necessary that accessible water and restrooms are on-site.

*Amputee Track Athletes*
An amputee track athlete should avoid running on asphalt and cinder tracks. Neither surface provides safe adhesion between the prosthesis and the ground. An eight-lane track is recommended for use.

Field Athletes

Special facility needs for a field athlete are few (Morse et al., 1995). The practice area must be secured and highly visible so that pedestrians do not walk into the throwing area. During hot weather training, it’s recommended that shading be nearby for the athlete during rest periods.

Weight Room

Most coaches will be using existing facilities to perform strength-training programs. Those who are able to develop from scratch should contact professionals from strength and conditioning programs who have already gone through a similar process. For the remainder, it’s critical to understand how to accommodate disabled athletes and how to position equipment to most effectively and safely use the space available.

The coach must consider the degree to which limited muscle function affects a given athlete. Limitations on muscle function will affect the athlete’s stability, body, and implement balance. It’s preferable that benches be wider than typical benches found in a weight room to brace the hips and back from rocking.

Using straps around the waist and, if necessary, the chest of wheelchair athletes is recommended for security. Cuffs, elastic wraps, orthoses or other similar devices will assist quadriplegics to secure and stabilize weights in their hands (Morse et al., 1995). Because wheelchair athletes are at high risk for skin pressure sores due to lack of sensation below lesion level and muscle atrophy, benches should be adequately padded. Independent cushions can be used if making permanent padding changes to benches is not possible (at a public gym, for example). Cushions must be solidly attached to prevent slipping.

Wheelchair athletes perform all lifting out of the wheelchair when possible (especially when lifting heavy free weights) because the wheels don’t provide a safe foundation from which to lift. Even if the wheels are locked, the wheelchair is still likely to rock laterally and rearward. It’s more appropriate to transfer into a high-back padded chair; a flat, decline, or incline bench; or a mat.

Resistance machine systems designed to preclude transfers do exist. These machines are...
specially built to reinforce and secure the wheelchair in such a way that it's safe to lift from it. There are drawbacks to such machines, however. The mechanics of exercise are static, they can’t be modified to enhance sport-specificity, and they cost a great deal more than do free weights (Morse et al., 1995).

Athletes always train with supervision or support personnel present. Supervision stations should be placed in areas with visibility to the entire gym and that allow quick access when spotters or immediate assistance is necessary (Armitage-Johnson, 1994). Spotters should be present at any station where athletes are lifting weights to fatigue or in which the poundage being used is near the maximum amount they can lift. Equally important, spotters must be familiar with the exercise being performed.

Wheelchair athletes typically do not lean down to pick up weights off the floor. Instead, spotters should hand them to the athletes. Stools or benches can be positioned at the sides of the athletes upon which weights can be placed to avoid having to place weights on the floor after each set. It’s recommended for wheelchair athletes or amputee athletes with limited balance that any weight over 15 pounds (or less for junior athletes) be taken off by a spotter.

The primary goal when positioning equipment is to make it accessible and safe for disabled athletes. Paths between and around equipment must be wide enough for wheelchair athletes to safely fit through. Protruding levers and arms from machines must be positioned away from paths so that blind athletes don’t run into them. Large machines must be bolted down to accommodate balance limitations. More generally, high-risk activities – including platform lifts, squats, overhead presses, bench and incline presses, and exercises requiring spotters – must be positioned away from windows, mirrors, exits, and entrances (Armitage-Johnson, 1994). Doing so will decrease the chances for breakage of glass, distraction, or collision with the bar or lifter. At same time, these high-risk activities must be done in areas readily supervised.

EQUIPMENT

**Racing wheelchair (Figure 1A, 1B)**

A properly fitting racing wheelchair acts as an extension of the athlete’s body, immediately responding to subtle muscle contractions. Using an oversized racing wheelchair is similar to running in oversized boots, and energy is wasted as the athlete struggles to control the wheelchair. A properly sized racing wheelchair fits close to the sides of the chest and at the hips to provide optimal stability. However, the fit must not be so tight as to cause constant rubbing and pressure. Blood flow to all areas of the skin in contact with the frame should never be constricted (Morse et al., 1995).
Most racing wheelchair manufacturers make available a measuring form asking for specific body measurements, which are used as guides during frame construction. The requested body measurements on the form are usually easy to understand. However, when questions arise, do call the manufacturer for clarification. Haphazard guesses are to be avoided.

It is recommended that the novice athlete purchase a less expensive, used wheelchair with adjustable knee, sitting, and back upholstery (Morse et al., 1995). Such a wheelchair will allow the athlete to discover the appropriate frame design, size, and seating position. Once experience is gained in a used wheelchair, there is greater likelihood that a new wheelchair will meet the athlete's needs and satisfaction.

**Racing wheelchair – Camber**

Camber is degree from which wheels rotate away from 90-degree angle in relation to floor (Morse et al., 1995). Camber in wheels allows for the athlete to sit lower in the cage without compromising hand ring coverage and stabilizes wheelchair in turns. Camber angle generally ranges from 7 degrees to 15 degrees with the most common amount being 11 degrees to 13 degrees.

**Racing wheelchair – Seat Position**

Appropriate seat position varies from athlete to athlete with two primary determinants: body dimensions and disability level. Seat position can be adjusted in the height the athlete sits above the axle, the degree the athlete sits in front of or behind the axle, and knee height. The athlete can also choose to sit with the legs tucked underneath the upper torso and behind the axle or with the legs in front of the axle extended forward toward the front wheel and resting on straps or footplate. There isn’t any existing research showing one leg position superior to the other. It’s simply a matter of preference, so try both.
The goals when deciding upon a seating position are optimal sitting stability and maximum coverage of the hand ring. To achieve stability, it is recommended that the angle of the back seat posts and the tension of the back upholstery be such that they combine to conform to athlete’s lower back curvature (Morse et al., 1995). Generally, the upper portion of posts should angle inward toward the front of the wheelchair, and the upholstery should pull tightly against the back area. This provides greater support and enhances aerodynamic efficiency.

**Racing wheelchair – Wheels and Tires**

Wheelchair track athletes predominately use 700c rear wheels and a 20-inch front wheel. Some, however, don’t have the arm or torso length to effectively use such a rear wheel size, and instead use 26-inch rear wheels and an 18-inch front wheel. The smaller wheel sizes are preferable for younger athletes until they grow into a body size sufficient to handle 700c rear wheels. Although 26-inch rear wheels are generally not capable of as high a speed as the 700c rear wheels on level ground or down hills, they are advantageous in accelerating and when climbing hills.

For novice athletes, spoked wheels with radial spoke patterns ranging from 24 to 36 spokes may also be used (Morse et al., 1995). Heavier athletes will require more spokes (e.g., 28-36) to ensure reliable performance. Lighter athletes can safely use wheels with 24-28 spokes. Spoked wheels are the most cost-effective wheels available for purchase.

For advanced athletes ready and able to make a larger financial investment in wheels, several options of carbon fiber wheels exist. Tri-spoke, quad-spoke, and disc models are available at $1000 to $1600 for a pair. For details regarding each model, speak with a wheelchair racing manufacturer or parts supplier. In general, carbon fiber wheels hold a distinct aerodynamic advantage over spoked wheels and are the wheels of choice on the professional wheelchair racing circuit.

Two models of tires exist: clinchers and sew-ups. A separate tube and tire casing is used for a clincher tire, whereas the tube and tire casing are one unit in a sew-up tire. Performance differences between the two are minimal. Both are available in a narrow profile (18mm), are lightweight (165gm), and can accommodate high pressure (130 psi). The striking difference is their cost. A punctured clincher can be fixed for under $10, while a punctured sew-up demands that an entire new tire be purchased at an average of $60. Additionally, clinchers require less maintenance. They sit on the wheel’s rim by being fastened to a bead. In contrast, sew-ups are
secured to the wheel’s rim with glue. If improperly glued, the tire can roll off the rim and cause severe damage to the wheel. That being said, most widely used are sew-up tires. A plausible explanation for this is their ease in being changed during a race or practice after a puncture. They can quickly be ripped off and a new tire quickly stretched on because they are one unit. It is recommended for the novice wheelchair track athletes choosing to use a sew-up to purchase a heavier tire weighing 200 or more grams with an 18 mm profile.

Racing wheelchair – Strapping

When pushing it is advantageous for the lower body to be stationary to provide a fixed platform from which to push. Extra lower limb movement absorbs energy being produced by the athlete and reduces the amount that can be transferred into the hand ring. Straps are therefore used to immobilize the lower limbs. Additionally, straps can be used to support the legs and prevent them from falling to the ground (Morse et al., 1995).

The straps to be used are made of non-elastic material. Stretch in material will allow movement and defeat the purpose of using straps. Strapping strategy varies depending on athlete’s disability level. At minimum, a strap should run across the lower back (the lumbar region) to keep the athlete down inside the cage.

Racing wheelchair – Compensator

The compensator is a triangular shaped piece of steel sitting above or underneath the main tube of frame. It is used on the track to push in and out of turns without manual steering. Essential components of the compensator are the cylinder, which attaches it to the front wheel, and two “stops,” usually allen head bolts, threaded through both sides of compensator. Adjusting the stops positions the front wheel as is necessary. The left-hand stop is set to the arc of the turn, while the right-hand stop is set for a straight line. When entering a turn, the athlete pushes the compensator on its left side to position the front wheel appropriately. Exiting a turn, the athlete pushes compensator on its right side to position the front wheel back to a straight-line setting. The desired amount of adjustment in stops varies on wind velocity, track lanes being used, and the speed the racing wheelchair is traveling. During the warm-up, it’s important the athlete sets the stops according to the conditions that will be experienced during competition.

Racing wheelchair – Hand Rings

Hand ring diameters generally range from 10 inches to 16 inches, with the most common size used being 14 inches for females and 14⅛ inches for males. The appropriate diameter is determined primarily by arm and torso length, but preference plays a role as well. The athlete should select a diameter that allows a comfortable reach to the bottom of the hand rings with the hands while sitting in a pushing position. Keep in mind that the diameter of hand rings acts much like gearing ratios on bicycles. A smaller sized hand ring enhances top-end speed, while a larger sized hand ring enhances quick acceleration and hill climbing (Morse et al., 1995).
In addition to choosing a hand ring diameter, the athlete needs to select the length of the stand offs, the tabs that attach the hand ring to the wheel. Stand offs range from 1/16 of an inch to 1 1/2 inches in length. An athlete who makes contact with the hand ring on its inside portion is recommended to get longer stand offs. An athlete who contacts the hand ring on its outside portion is recommended to get shorter ones.

When attaching a hand ring to spoked wheels, the spokes must be kept in front of the stand offs. This allows the propulsive force to push into the spoke. If the spoke is behind the stand off, the force pulls spoke away from hand ring, increasing the likelihood the two will detach.

**Maintenance of Chairs**

**Hand Rings**

Periodically, the rubber coating (made of a standard tire) on the hand ring will need to be replaced. The repeated contact between the gloves and hand rings will wear through the rubber surface to a white inner casing and impair its adhesion.

The tools necessary for replacing hand rings are contact cement, scissors, electrical tape, and a sew-up tire with a herringbone tread pattern.

1) Begin by cutting through the sew-up tire on either side of the valve stem. Remove the tube. (Figure 3A)

2) Cut the sidewall out but leave 1/16-inch of sidewall on both sides of the black rubber in order to provide more purchase to the hand ring during gluing. (Figure 3B)

3) Remove the worn rubber coating from the hand ring using a pair of pliers. A heat gun (a paint stripping gun) can also be used to soften contact cement to make the removal with the pliers easier. The hand ring must be free of residual glue. (Figure 3C)

4) Apply contact cement to the entire hand ring and the underside of the tire. (Figure 3D)

5) Allow the hand ring and the tire to dry for 10 minutes to 20 minutes and become tacky.

6) Press 1/4 inch of the tire onto the hand ring. Secure the tire by wrapping the electrical tape around it, and then work around the rest of the hand ring, securing the tire to its aluminum surface. It's very important to stretch the tire when sticking it to the hand ring. Doing so gives it a circular shape and allows it to conform to the hand ring's shape. (Figure 3E)

7) Allow the hand ring to cure for 48 hours for an adequate bond, and then remove the electrical tape. Allow one hour to two hours of continuous pushing to soften and rough up the rubber surface for optimal adhesion.

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**PUSH INTO THE SPOKES**
Alignment

The alignment of the racing wheelchair is measured with respect to the degree the wheels are toed-in or toed-out and the degree to which they are parallel with main tube (Morse et al., 1995). Toe-in and toe-out are the variations in the distance measured at axle height between two parallel wheels at their front and rear. If the distance is greater at the rear, the chair is toed-in; if the distance is greater at the front, the chair is toed-out. Ideally, the wheels are parallel, being neither toed-in nor toed-out. At the same time, the distance between the wheels and the main tube is identical, ensuring that the wheels are parallel with the frame and not tracking to the left or right (usually called “dog-tracking”).

Chair manufacturers build devices to measure toe-in/toe-out and can offer the best advice on how to adjust the alignment if necessary. It’s critical that when measuring alignment that the athlete sits in the frame. Because of routine flex in the chair’s aluminum, toe-in/toe-out varies when the athlete is either in or out of the racing wheelchair.

General

Many details of the racing wheelchair need periodic checking. The frame itself needs to be checked for cracks, especially in welded areas that bear most of the athlete’s weight. Axles, bolts/nuts, springs, and cylinders need to be checked for rust, and then lubricated if necessary. Tires need to be checked for worn spots or tears and for areas where they might be rolling off the rim. On the wheels, loose spokes and hand ring stand offs need to be tightened.

Helmet

Wheelchair Athletics USA (WAUSA) rules require that helmets be worn at road races and any track event from the 800 meters and longer. The only rule guiding helmet selection is that it must meet the safety standards of the American National Safety Institute (ANSI). Once this critical detail is satisfied, a helmet that is lightweight, well ventilated, and has a smooth outer surface for enhanced aerodynamic efficiency is preferable. Most bicycle shops offer a wide selection of helmets with prices ranging from $30 to $200. It is strongly recommended that the extra money necessary to purchase a high-quality helmet be spent. Saving a few dollars buying a cheap $30 helmet isn’t worth the risk of an accident-caused brain injury.
Gloves

The traumatic forces experienced by the hands during wheelchair racing demand that appropriately padded gloves are used. Without such protection, soft tissue injuries will occur. Three standard glove options exist. Snugly fitting handball/baseball gloves that are heavily wrapped with such materials as foam padding, elastoplast, medical tape, and cloth friction tape for padding and adhesion can be used (Morse et al., 1995). Moldable plastic materials such as Aquaplast® can be heated and formed around the hands, creating a custom-fitted glove. A specialized racing glove made of leather and rubber can be ordered in standard sizes. Choosing to purchase pre-made specialized racing gloves is the best starting point for novice wheelchair track athletes. Such gloves were designed to ensure safety and will save the time it takes to build gloves.

Field Implements (adapted from ISMWSF guidelines)

It’s important for a field athlete to select the throwing implement that provides the potential for the greatest possible distance. Bear in mind that personal implements can be used during competition, but they must be checked by the organizers prior to the competition and can subsequently be used by other competitors.

**Shot**

The shot is a spherical shaped implement with a smooth surface, being either solid or filled. Rules mandate that it be made of iron, brass, or a material equally as hard as brass and, if filled, a material such as lead be used. The weight of the shot is 2, 3, 4, or 5 kilos depending on the athlete’s class.

**Discus**

The discus is a wooden (or similar material), saucer-like implement. Running around its circular edge is a metal rim with a cross section rounded in a true circle that has a radius of 6mm. The sides of the discus are identical and cannot have any indentations, projections, or sharp edges. At the same time, the sides must taper in straight lines from the beginning of the curve of the rim to a circle of a radius ranging from 25mm to 28.5mm from the discus’ center. A lighter weight sponge discus is available for junior athletes to use.

The distribution of weight in the discus is one variable not dictated by rules. Distribution of weight is important because it influences the discus’ inertia. A discus with more weight in the center has a low moment of inertia, while one with more weight around its outer edge has a high moment of inertia.

**Javelin**

The javelin consists of three parts: a head, a shaft, and a cord grip. The head is metal with a sharp point and is attached to a shaft similarly made of metal. The grip is located around the javelin’s center of gravity and cannot have thongs, notches, or indentations, but can have a non-slip pattern.

The longitudinal profile from grip to front tip and grip to tail is straight or slightly convex. Any sudden change in diameter throughout the length of the javelin (except at the front and rear of the grip) is prohibited. Also prohibited are any mobile attachments that might change its center of gravity during flight. Its minimum weight acceptance when throwing from a sitting position is 600gm, and when throwing from a standing position is 800gm.
Javelins are aerodynamic implements designed to travel at distances that correlate to the thrower’s ability, which means that as the thrower becomes more adept, javelins with the potential to stay in flight longer should be selected. An important factor to consider when deciding on an appropriate javelin is the surface area of its tail. A thrower with more ability will need to use a javelin with less surface area on the tail in comparison to a thrower with less ability. This is because of the javelin’s changing position during flight: it begins pointed up and ends pointed down. As it travels through the air, the tail section catches more air than the front, thereby causing the javelin to rotate forward around its center of gravity. Therefore, the greater the distance it will travel, the slower the forward rotation has to be.

**Club**
The club is a wooden implement with a length ranging from 35 cm to 39 cm and weight ranging from 397 gm to 425 gm. For juniors, the club is 16 inches long and weighs 12 ounces to 15 ounces. Athletes in the F51 class and some athletes with cerebral palsy compete in the club.

**Throwing Chair**
The throwing chair provides a stable lower-level foundation from which to throw. At the most basic, it is a seating platform welded to four supporting posts. Individual design varies but always under the rules that the height of the chair not be more than 75cm to the top of the seating surface and that it fit in the throwing circle. Certain modifications to this basic design can be made for some classes, such as an added footrest. Tie-down straps are allowed to secure the throwing chair to the ground, but they must be non-elastic.

**Prosthetic Devices (Figure 2)**
Achieving the proper fit and fabrication of a prosthesis results from input provided by the athlete, physical therapist, and prosthetist (Curtis, 1993). Together, they can sift through the scores of different components available to be used in fabrication and decide which ones will best meet the athlete’s specific needs.

The demands placed on a prosthesis in competition are quite different than during everyday use. For that reason, it’s ideal to have a prosthesis to be used for everyday activities and a separate one to be used in competition. This is not possible for many novice athletes because of financial restrictions. However, they can still work with their prosthetist to develop a prosthesis acceptable to their needs.

The prosthetic limb consists of three or four parts, depending on the amputation level. For below-the-knee amputees (BK), it consists of a socket, a shank, and a foot. For above-the-knee amputees (AK), it consists of a socket, a knee, a shank, and a foot.

**Socket**
The socket is the shell in which the stump is housed, merging the athlete’s leg and the prosthesis into a single unit. The fit of the socket is therefore crucial. It must be tight enough to prevent loosening but not tight to the point that circulation is impaired. The standard socket used by BKS is the Patellar-Tendon-Bearing (PTP) design in which the stump bears the amputee’s weight. Soft foam liners are
often used to cushion the stump. The PTB socket is generally held in place by one of three methods: 1) a cuffing system that runs above the knee cap or around the waist; 2) a suction-docking system in which a silicone sleeve or liner attaches into a locking mechanism on the prosthesis; 3) the shape of the socket's brim.

Suitable sockets for AKs take advantage of the available muscle mass in the leg, of which there are several possible designs. AK sockets are held on by suction or by a neoprene suspension belt.

**Knee**
There a variety of articulating knee systems from which AKs can choose, including friction, pneumatic, and hydraulic. Most widely used for athletics are hydraulic devices. Complex hydraulic knee devices are capable of controlling both the swing and the stance with a single hydraulic cylinder. Such devices allow the athlete to control running velocity by varying knee flexion and extension, while simultaneously cause the knee to brake automatically, which prohibits the knee from buckling (Curtis, 1993). No matter the device, the chief concern in a knee system is to avoid buckling during the support phase of running.

**Shank**
The shank attaches the socket or the knee to the foot and carries the forces being applied by the amputee through the foot and onto the ground. The shank can be either exoskeleton or endoskeleton (also called pylon). An exoskeleton shank is hollow and shaped like a leg, and it transfers the forces via its outside walls. An endoskeleton shank is composed of a tube, through which the forces travel.

**Foot/Ankle**
The dynamic response foot is the design primarily used in athletics. It is constructed to flex and absorb energy during the ground strike and support phase of running, and then to spring back to assist in a powerful thrust during the driving phase. It connects directly to the shank or the knee, depending on the brand. A very popular model, The Flex Foot™, is available in foot/ankle and foot/ankle/shank systems to accommodate different amputation levels.

**Prosthesis Maintenance and Repair**
It is recommended that any problems encountered with the prosthesis be taken directly to a prosthetist with the knowledge and skills to make the appropriate repairs. The prosthesis should also be taken to a prosthetist every six to 12 months for routine inspection.

**COACHING ATHLETES WITH VISUAL IMPAIRMENTS**

Athletes with visual impairment may range from potential sight to total blindness. The athlete may have loss of peripheral vision or central vision, blurred vision, light perception with little of no visual acuity or total blindness. The coach should ask the athlete to describe any residual sight in order to clarify how the visual impairment affects track and field. It is also helpful to know the age of onset. Congenital (from birth) or early onset visual impairment often adversely affects the development of basic motor skills and the coach may need to spend more time on motor development.

Athletes will typically need to be oriented in order to be familiar with the competition site. Verbal communication is important to enable the athlete to perform well. Feedback should be clear and concise. Confirm whether or not the athlete understands the verbal instructions by asking and observing the athlete. B3 athletes (minimally impaired) use IAAF rules. B2 athletes may run with or without a guide runner. B1 athletes (totally blind or only light perception) require guide runners for races over 100 meters. Guide runners start in front of the athlete (including in front of starting
line) but must finish behind the athlete. Guide runners may run with the athlete but without contact; hold the athlete’s elbow; or with a tether. When using a tether, the athlete and the guide runner hold the non-elastic rope of cord. The athlete and guide should not be tied together. In the 100m B1 event athletes run one at a time in a time trial with up to two callers. In races over 100m, B1 and B2 athletes have two lanes each.

**Equipment Precautions**

Coaches for wheelchair track athletes need to pay attention to skin areas below sensation level for possible skin breakdown indicated by red spots, cuts, or abrasions. To limit such hazards, proper cushioning is used so that there is an even distribution of pressure over areas that experience constant pressure. Wheelchairs are checked for any sharp edges, which should be filed down smooth.

Torn straps or upholstery need to be replaced and loose bolts and attachments tightened. Breakdown of any one of these can cause serious injury.

Wheelchair track athletes must have a properly fitting helmet that is always worn, both on the track and on the road. Consult the directions accompanying the helmet to achieve an appropriate fit. A functional front brake is also necessary, and is checked that it works properly before every training session.

**Track and Road Rules**

For wheelchair track athletes training on road, a 5-foot to 6-foot neon orange flag is placed on back of the racing wheelchair. Additionally, athletes need to stay as far right on the road as possible. These two precautions are necessary because racing wheelchairs assume a low profile on the road, making them difficult for motorists to see. Before beginning any road training, check state laws to determine whether training in a racing wheelchair on the road is legal. When training on the track by both ambulatory and wheelchair athletes, hurdles must be removed from the lanes, and the track surface cleaned of any sharp objects such as spikes left from runner’s shoes. Stress track awareness, i.e., being aware of where other athletes are. This means that athletes’ heads should be up, allowing them to see around. Slower athletes stay on outside lanes, allowing faster athletes the inside. However, if a faster athlete comes upon a slower athlete in the same lane, it’s the faster racer’s responsibility to move around the slower racer.

**DEVELOPING A SEASON PLAN**

A successful season plan does not consist of general workouts applied to all athletes. Rather, the plan must be individualized. Before the season begins, a coach must have a solid understanding of the athlete’s potential and his/her season goals, supplemented by an understanding of basic training principles.

**Athlete’s potential**

The athlete must be evaluated objectively and observed subjectively to identify potential. By collecting data – times, distances – and by observing, the coach can more adequately design a season plan with realistic expectations. In addition, renowned strength and conditioning specialist Tudor Bompa (1999) recommends the coach consider the following factors:

**Training background**: The training demands are set proportional to training experience. For example, athlete A who has been training for five years with high compliance rate will need a higher training volume than athlete B who has been training two years.
**Biological and psychological factors**: These factors, which determine an individual’s capacity for work and performance, will vary from athlete to athlete.

**Recovery rate**: The training demands are set proportional to an athlete’s recovery rate. Athlete A, who possesses a high fitness level, will recover more quickly than athlete B who possesses a low fitness level.

**Season Goals**

The athlete and coach must meet and decide what are the season’s goals. Together, they target specific competitions when the athlete’s performance must be at its peak.

**Basic Training Principles**

In order to design a sound training plan, the coach must understand the basic training principles:

**Overload** – A plan must progress so that as the body adapts to growing demands of strenuous exercise, the amount of work continually increases. Through increasing the amount of work, the body responds and grows stronger. Without steady increases, the athlete’s fitness level will drop.

**Specificity** – Effective training must be similar to the athlete’s sport and be designed to develop sport-specific speed, power, endurance, and technique. The amount each is developed depends on the sport the athlete competes in.

**Intensity** – The degree of intensity directly relates to increases in overload. A greater amount of overload demands a greater intensity. Intensity can be regulated by training at specific percentages of maximum heart rate, maximum strength, or maximum speed.

**Recovery** – Recovery occurs between each set and training session, allowing the body to replenish energy stores.

**Type** – Type is the mode of training, whether it be strength training or plyometrics.

**Organizing a Season**

An organizing strategy highly recommended is periodization, in which the training year is divided into time segments or periods. There are typically three periods, preparatory, competitive, and transition, labeled according to their training focus. Each of these periods is then broken into smaller phases. Preparatory into general and sport-specific; Competitive into early season and peak; Transition into complete and active recovery. These phases are made up of one or more monthly cycles, which are subsequently made up of three to six weekly cycles.

The purpose of dividing the season in such a way is to enable the athletes to perform at their peak capacity during their most important competitions. The periodization strategy achieves this goal through a progression of overloading the athletes’ physical and mental systems followed by lower intensity rest and regeneration periods. Generally, the progression is from general training of low intensity and high volume to specific training of high intensity and low volume.

**Preparatory Period**

The first period usually comprises one-third of the season and is divided into general preparation and sport-specific preparation.
During general preparation, athletes train general strength, flexibility, and endurance. This phase provides athletes with a broad foundation as they prepare for the sport-specific training to come. Pillar strength is developed now, i.e., strength in the abdominal muscles, the lower back, and the spinal column musculature, which provides general stability to the athletes. Stabilizers, muscles that prevent injuries, are developed as well.

Sport-specific preparation narrows down the training scope. This phase develops strength, flexibility, endurance, tactics, and technique specific to the athlete’s sport (Morse et al., 1995).

**Competitive Period**
The competitive phase is a time to strive for perfection, and is divided into early competitive and peak.

From early competitive to peak, the focus is on evaluation and improvement of performance within progressively more difficult competitions. Training stresses skill and technique work – particularly in areas shown in competitions to be weak – and maintaining gains from the preparatory period. By choosing progressively more difficult competitions, athletes will be better prepared for their most critical competitions.

The peak phase can from two to five weeks during which the athletes’ most critical competitions occur. Like early competitive, emphasis is on technique, tactics and skills, and maintenance of conditioning. Overloading the athletes during this phase is pointless, as any gains from such work won’t be evident until after the critical competitions are over and can only serve to harm their performance. It is more preferable to use training that simulates competition as closely as possible, both physically and mentally.

**Transition Period**
The transition period gives athletes much needed physical and mental rejuvenation and an opportunity to recover from lingering illnesses or injuries. This period usually begins with complete recovery, which is limited to one or two weeks. Complete recovery lasting longer can cause athletes to lose the strength and speed they’ve gained in earlier phases.

The remainder of the period is spent in active recovery. During active recovery, athletes use low training volume and intensity to achieve maintenance of weight and general conditioning. In order to get away from their specific sport, athletes are recommended to cross train by participating in alternative activities for training. Examples include basketball, tennis, cycling, swimming and hiking.

This phase is also the time when coach and athlete meet to discuss goals for upcoming season.

**Weekly and Monthly Cycles**
The building blocks of periods and phases are the weekly cycles, during which the intensity of training sessions is manipulated for optimal results. The weekly cycle is structured around two high-intensity training sessions during which the muscles’ energy stores are depleted. The remainder of the week is designed to allow the athletes to maximize the high intensity sessions. The day following is either for complete recovery or a low-intensity training session. Two days following is a medium intensity training session to prepare athletes for the next day’s high intensity demands.
Consider the following when designing a weekly cycle:

1) Identify the week’s goals in relation to its period and phase.
2) Decide how many days during week will be used for training and how many for rest.
3) Decide how many high-intensity training sessions the week will have.
4) For each training day, determine if training will occur on the track, in the weight room, in the swimming pool, etc.
5) Each week starts with a low or medium intensity day.
6) High-intensity days are separated by 48 hours.
7) The day after high intensity is either complete recovery or low intensity.
8) Be aware of fatigue in athletes. The coach may have to change the training session plan if the athlete is too tired.

Weekly cycles are subsequently combined and designed to form monthly cycles of three-week to six-week periods. Monthly cycles simulate weekly cycles on a broader scale. They also progressively grow in intensity from week to week and follow such progressive overloading with a week of lower intensity unloading to allow adaptation to occur. The recovery in monthly cycles is very significant because its length is such to allow the athlete time to grow stronger and faster and more tolerant to increased training demands. Improvements in athlete performance are often observable after these cycles.

**Typical Season Plans**

<table>
<thead>
<tr>
<th>Field</th>
<th>Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ September through December: Transition</td>
<td>♦ August through October: Transition</td>
</tr>
<tr>
<td>♦ January through March: General Preparatory</td>
<td>♦ November through December: General Preparatory</td>
</tr>
<tr>
<td>♦ April through June: Specific Preparatory</td>
<td>♦ January through March: Specific Preparatory</td>
</tr>
<tr>
<td>♦ July through August: Competition</td>
<td>♦ April through July: Competition</td>
</tr>
</tbody>
</table>

**Athlete Classification**

A classification system is used in disabled track and field to provide for more equitable competition. With any given disability, there is a wide variation in severity of impairment. For instance, an individual with spinal cord injury at neck level is far more restricted in functional muscle potential than is an individual with a spinal cord injury at waist level. Given that fact, it would not be equitable for the former athlete with limited upper-limb mobility to compete against the latter athlete with fully functional upper-limb mobility. A classification system is used to avoid this situation, organizing athletes into classes according to functional potential.

Following are the classes guiding competition at the national and international levels.

**Blind** *(as presented by the International Blind Sports Federation [IBSA])*

**Class B1**
Total absence of perception of the light in both eyes, or some perception light but with inability to recognize the form of a hand at any distance and in any direction.
**Class B2**
From the ability to recognize objects or contours up to a visual acuity of 2/60 and/or a visual field of less than 5 degrees.

**Class B3**
From a visual acuity of above 2/60 to a visual acuity of 6/60 and/or a visual field or more than 5 degrees and less than 20 degrees.

All classifications must be made by measuring the best eye and to the highest possible correction. This means that all athletes who use contact lenses or correcting glasses normally must wear them during classification, whether or not they intend to use them during competition.

**Wheelchair Track** (as presented by International Stoke Mandeville Wheelchair Sports Federation [ISMWSF])

**Class T-1**

*Functional Ability:* May use elbow flexors to start (the back of the wrist behind the hand ring). Hands stay in contact or close to the pushing rim, with the power coming from elbow flexion. The old technique is to use the palms of the hands and to push down on the top of the wheel in a forward direction. *Neurological Level:* C6 *Anatomical Capability:* Have functional elbow flexors and wrist dorsi-flexors. Have no functional elbow extensors or wrist palmar flexors. May have shoulder weakness.

**Class T-2 (can be T2A or T2B)**

*Functional Ability:* Usually use elbow flexors to start, but may use elbow extensors. Power from pushing comes from elbow extension, wrist dorsi-flexion, and upper chest muscles (Matson technique). Additional power may be gained by using the elbow flexors when the hands are in contact with the back of the wheel. The head may be forced backwards (by the use of neck muscles), producing slight upper trunk movements.

**T2A Neurological Level:** C7 *Anatomical Capability:* Have functional pectoral muscles, elbow flexors and extensors, wrist dorsi-flexors, radial wrist movements, some palmar flexors. Have no finger flexors or extensors.

**T2B Neurological Level:** C8 *Anatomical Capability:* Have functional pectoral muscles, elbow flexors and extensors, wrist dorsi-flexors, and palmar flexors, radial and ulnar wrist movements, finger flexors and extensors. Do not have the ability to perform finger abduction and adduction (spread fingers and bring them together).

**Class T-3**

*Functional Ability:* Have normal or nearly normal upper limb function. Have no active trunk movements. When pushing, the trunk is usually lying on the legs. The trunk may rise with the pushing action. Usually use a hand flick technique for power (or Friction technique). May use the shoulder to steer around curves. Interrupt pushing movements to steer, and have difficulty resuming the pushing position. When braking quickly, the trunk stays close to the pushing position. NOTE: Scoliosis (curvature of the spine) usually interferes with abdominal and back muscle function.

*Neurological Level:* T1 - T7 *Anatomical Capability:* Have normal or nearly normal upper limb function. Have no abdominal muscle function. May have weak upper spinal extension.
Class T-4

*Functional Ability:* Have backwards movement of the trunk. Usually have rotation movements of the trunk. May use trunk movements to steer around curves. Usually do not have to interrupt the pushing stroke rate around curves. When stopping quickly, the trunk moves towards an upright position. Use abdominals for power particularly when starting but also when pushing.

*Neurological Level:* T8 - S2  
*Anatomical capability:* Have back extension that usually includes both upper and lower extensors. Usually have trunk rotation, which indicates abdominal muscles.

**Wheelchair Field** (as presented by International Stoke Mandeville Wheelchair Sports Federation [ISMWSF])

Class F1

*Functional Ability:* Have no grip with non-throwing arm. (Use 'resin' or adhesive-like substance for grip.) Discus: Have little control of the discus because finger movements are absent. Throw with a flat trajectory. Club: May throw forward or may throw backward over their head. Use either thumb and index finger, or index and middle finger, or middle and ring finger grip. (Club - when throwing backwards, the athlete is using his/her strong elbow flexors.)

*Neurological Level:* C6  
*Anatomical Level:* Have functional elbow flexors and wrist dorsi-flexors. May have elbow extensors (up to power 3) but usually do not have wrist palmar flexors. May have shoulder weakness. Have no sitting balance. NOTE: This system applies to the spinal injured athlete. Athletes whose disability is a result of polio or other causes, may show different movement and function than described here. However, the total function of the athlete in this specific event shall be similar to that of the spinal cord injury description.

Class F2

*Functional Ability:* Have difficulty gripping with non-throwing arm. Shot: Unable to form a fist and therefore do not usually have finger contact with the shot at the release point. Unable to spread fingers apart. Discus: Have no functional finger flexors so unable to form a fist. Have difficulty placing fingers over the edge of the discus, but may do so with the aid of contracture or spasticity. Javelin: Usually grip the javelin between the index and middle fingers, but may use the gap between the thumb and index finger, or between the middle and ring fingers. These athletes may have slight function between the digits of the hand.

*Neurological Level:* C7  
*Anatomical Capability:* Have functional elbow flexors and extensors, wrist dorsi-flexors and palmar flexors. Have good shoulder muscle function. May have some finger flexion and extension but not functional. NOTE: This system applies to the spinal injured athlete. Athletes, whose disability is as a result of polio or other causes, may show different movement and function than described here. However, the total function of the athlete in this specific event shall be similar to that of the spinal cord injury description.

Class F3

*Functional Ability:* Have nearly normal grip with non-throwing arm. Shot: Usually a good fist can be made. Can spread the fingers apart but not with normal power. Use some spreading of the fingers, and can "grasp" the shot put when throwing. Discus: Have good finger function to hold discus. May be able to import spin on the discus. Are able to spread and close the fingers, but not
with normal power. Javelin: Usually grip javelin between the thumb and index finger. Have ability to hold javelin because of presence of hand muscles that spread and close the fingers.

Neurological Level: C8

Anatomical Capability: Have full power at elbow and wrist joints. Have full or almost full power of finger flexion and extension. Have functional but not normal intrinsic muscles of the hand (demonstrable wasting).

Class F4

Functional Ability: Shot, Discus, and Javelin: Have no sitting balance. Usually hold onto part of the chair while throwing. Complete Class 2 and upper Class 3 athletes have normal upper limbs. They can hold the throwing implement normally. They have no functional trunk movements. Incomplete 1C athletes are those who have trunk movements and with hand function like F3 athletes.

Neurological Level: T1 - T7

Anatomical Capability: See above.

Class F5

Functional Ability: Three trunk movements may be seen in this class:

1) Off the back of a chair in an upward direction.
2) Movement in the backward and forward plane.
3) Some trunk rotation.

Have fair to good sitting balance. Cannot have functional hip flexors, which enables the thigh to be lifted upwards in the sitting position. May have stiffness of the spine that improves balance but reduces the ability to rotate the spine. Shot and Javelin: Tend to use forward and backward movements, whereas the Discus predominantly uses rotary movements.

Neurological Level: T8 - L1

Anatomical Capability: Normal upper limb function. Have abdominal muscles and spinal extensors (upper or more commonly upper and lower). May have nonfunctional hip flexors (grade 1). Have no adductor function.

Class F6

Functional Ability: Shot, Discus, and Javelin: Have very good balance and movements in the backward and forward plane. Have good trunk rotation. Can lift the thighs off the chair (hip flexion). Can press the knees together (hip adduction). May have the ability to straighten the knees (knee extension). May have some ability to bend the knees (knee flexion).

Neurological Level: L2 - L5

Anatomical Capability: See above.

Class F7

Functional Ability: Shot, Discus, and Javelin: Have very good sitting balance and movements in the backward and forward plane. Usually have very good balance and movement toward one side
(side to side movement) due to presence of one functional hip abductor on the side that movement is toward. Usually can bend one hip backward in order to push the thigh into the chair. Usually can bend one ankle downward in order to push the foot onto the foot plate. The side that is strong is important when considering how much it will help functional performance.

**Neurological Level:** S1 - S2

**Anatomical Capability:** See above.

**Class F8**

Shot, Discus, and Javelin: Have normal sitting balance and trunk movement in all planes. Usually are able to stand and possibly walk with braces or by locking knees straight. Are unable to recover balance in standing position when balance is challenged and will fall when attempting throws with full effort in standing position. Not more than 70 points are allowed in the lower limbs of athletes who, because of poor dynamic standing balance, choose to compete from a seated position. United States class only. NOTE: Any athlete who wishes to be considered for international competition in F8 must: 1) not have more than 70 points in the lower limbs. 2) must compete from a standing position at regional/national competition.

**Class F9**

Standing: Internationally, this class would compete in the 42, 43, 44 class with other ambulatory classes because there is no longer a wheelchair standing class in international competition.

**Athletes with Cerebral Palsy, Traumatic Brain Injuries, and Stroke**  
(as presented by Cerebral Palsy International Sports and Recreation Association [CP-ISRA])

**Class C1**

A Class 1 athlete has severe quadriplegia (tetraplegia). Spasticity Grade 4 to 3+, with or without athetosis, or with poor functional range of movement and poor functional strength in all extremities and trunk OR the with severe athetosis with or without spasticity with poor functional strength and control. Dependent on power wheelchair or assistance for mobility. Unable to functionally propel a wheelchair.

Lower Extremities:
Considered non-functional in relation to any sport due to limitation in range of movement strength and/or control. Involuntary movement would not change this classification.

Trunk Control:
Static and dynamic trunk control very poor or non-existent. Severe difficulty adjusting back to mid-line or upright position when performing sports movements.

Upper Extremities:
Severe limitation in functional range of movement makes this the major factor in all sports, and reduced throwing motion with poor follow-through is evident. Opposition of thumb and one finger may be possible allowing athlete to grip.

**TRACK**
Determined purely on the lack of independent means of manual self propulsion other than being pushed or using an electric chair. Manual propulsion if possible is nonfunctional. Problems arise when someone in an electric chair has more functional ability in arms and hands. In this case arm and hand function are the determining factor in evaluation, and they may be Class 2.
FIELD
Determined clearly by the very poor hand function to handle club, shot or discus, in conjunction with throwing motion. A person could have somewhat adequate hand function statically, but may have less function when throwing due to athetoid involvement.

Class C2
A Class 2 athlete has severe to moderate quadriplegia (tetraplegia). Spasticity Grade 3+ to 3, with or without athetosis. Severe athetoid or tetraplegic with fair function in less affected side. Poor functional strength in all extremities and trunk but able to propel a wheelchair.

Lower Extremities:
A demonstrable degree of function in one or both lower limbs allowing propulsion of the wheelchair automatically qualifies individual as a Class 2 lower, unless the classification team determines that the upper limb function is more efficient. Class 2 lower athletes can sometimes ambulate.

Trunk Control:
Static control is fair. Dynamic trunk control is poor as demonstrated by the obligatory use of upper extremities and/or head to assist in returning to the midline (upright position).

Upper Extremity: Hand:
Severe to moderate involvement. Spasticity Grade 3. If hand and arm function is described as in Class 1 then lower extremity will determine whether Class 2 is more appropriate.

A Class 2 athlete often has a cylindrical or spherical grasp, and demonstrate sufficient dexterity to manipulate and throw a ball but will exhibit poor grasp release. Throwing motions must be tested for effects on hand function. Wheelchair propulsion with upper extremities is also demonstrable. Active range of motion is moderately to severely impaired, thus hand function is the key.

TRACK
Class 2 lower:
Lower extremity track events are performed using a foot-propelled wheelchair push. The chair may be pushed forwards or backwards but must be propelled solely by the feet.

Class 2 upper:
Upper extremity events are performed by pushing the wheelchair with one or two arms. Wheelchair propulsion is restricted due to poor control and/or Grade 3 spasticity.

FIELD:
Lower extremities athletes will kick or thrust with their feet. Upper extremity athletes have limited control of movements, but are able to show some semblance of throwing motion. Athletes may compete in both upper and lower extremity events.

Class C3
A Class 3 athlete has moderate (asymmetric or symmetric) quadriplegia or severe hemiplegia. Use of wheelchair with almost full functional strength in dominant upper extremity. Can propel a wheelchair independently.
\textit{Lower Extremities:}
Spasticity is a Grade 3 to 4. Some demonstrable function can be observed during transfer. May be able to ambulate with assistance or assistive devices.

\textit{Trunk Control:}
Fair trunk control is shown when pushing wheelchair, but forward trunk movement is often limited by extensor tone during forceful pushing. Some trunk movement can be noted also in throwing for postural correction, but throwing motions are mostly from the arm. This is a major factor in non-ambulatory capability. Rotation is limited or non-existent. Spasticity is Grade 2 to 3+.

\textit{Upper Extremities:}
Moderate limitation. Spasticity Grade 2 to 3+ in dominant arm shown as limitation in extension and follow-through.

\textit{Hand Function:}
Rapid grasp and release hand movements are usually slow and labored. Dominant hand may demonstrate cylindrical and spherical grasp, but release of objects is noticeably less than a Class 4 athlete.

\textbf{TRACK}
Usually some difficulty arises with individuals who show wheelchair mobility which falls between Class 3 and 4. The key is trunk mobility in propulsion of the chair, and hand function. If an athlete is unable to use rapid trunk movements, symmetric long strokes with rapid grasp and release when pushing, he is a Class 3. An athlete using only one arm for wheelchair propulsion may have long strokes and rapid grasp and release in the dominant arm and still be a Class 3.

\textbf{FIELD}
Sometimes a hemiplegic athlete with Spasticity Grade 3 to 4 in the non-dominant arm and near normal function in the dominant arm, or a Class 3 asymmetric diplegic athlete is more appropriate in Class 4. However, a close look should be given to the trunk movement, as it is often the determining factor. In all cases, movement, follow-through and release are ultimate considerations. Split classes can sometimes occur in these cases.

\textbf{Class C4}
A Class 4 athlete has moderate to severe Diplegia. Good functional strength, with minimal limitation or control problems in upper limbs and trunk.

\textit{Lower Extremities:}
Moderate to severe involvement in both legs. Spasticity Grade 3 to 4 rendering them non functional for ambulation over long distances without the use of assistive devices. A wheelchair is usually the choice for sport.

\textit{Trunk:}
Minimal limitation of trunk movements. Spasticity Grade 1 to 2 when wheeling and throwing. In some athletes, fatigue can increase spasticity, which can be overcome with proper positioning. When standing poor balance is obvious even using assistive devices.

\textit{Upper Extremities:}
The upper extremities often show normal functional strength. Minimal limitation of range of movement may be present but a normal follow-through and propulsion is observed when throwing or wheeling.
**Hand Function:**
Normal cylindrical/spherical opposition and prehensile grasp is seen in all sports. Limitation if any is usually apparent only during rapid fine motor tasks. It should be remembered that diplegia implies that there is more spasticity in the lower than the upper extremities. Some involvement Spasticity Grade 2 can be seen on close examination, particularly in functional movements of the hands, arms and trunk.

**TRACK**
Split classification between Classes 4 and 5 in FIELD is often considered a matter of preference for athletes is they are eligible functionally. The hemiplegic in a wheelchair with one functional arm may be Class 4 for field events (see also Class 3 -Field).

**Class C5**
A Class 5 athlete has symmetric or asymmetric moderate diplegia. The individual may require the use of assistive devices in walking but not necessarily when standing or throwing. A slight shift of center of gravity leads to loss of balance.

**Lower Extremities:**
Spasticity is Grade 3. Involvement of one or both legs which may require assistive devices for walking. A Class 5 athlete may have sufficient function to run on the track. If function is insufficient Class 4 may be more appropriate.

**Balance:**
Usually has normal static balance but exhibits problems in dynamic balance, e.g. attempting a spin or throwing forcefully.

**Upper Extremities:**
This is an area where variation occurs. Some moderate to minimal limitation in upper extremities can often be seen, particularly when throwing but strength is within normal limits.

**Hand Function:**
Normal cylindrical/spherical opposition and prehensile grasp and release in the dominant hand is seen in all sports.

**FIELD**
The major problem is dynamic balance and function when standing in sport with or without assistive devices. Class 5 athletes may use a run-up in field events.

**Class C6**
Moderate athetosis or ataxia. Athlete ambulates without aids. Athetosis is the most prevalent factor, although some athletes with ambulant spastic quadriplegia (i.e., more arm involvement than in ambulant diplegia) may fit this class. All four limbs will usually show functional involvement in sports movements. Class 6 athletes usually have more control problems in upper limbs than Class 5 athletes, although the former usually have better function in lower limbs, especially when running.

**Lower extremities:**
Hemiplegia spasticity grade 3 to 2. Dominant side has better development and good follow-through movement in walking and running. Persons with moderate to minimal athetosis do not fit into this class.
Balance:
Usually has normal static balance but may exhibit problems in dynamic balance, e.g. attempting a spin or throwing forcefully.

Upper extremities:
Arm and hand control is only affected in the non-dominant side. There is moderate functional control on the dominant side.

TRACK
Athetosis means unsteady (writhing), not having the capability to remain still. A consequence is that starting may present difficulties (e.g., false starts). Cyclic movements however are much better performed, like cycling, running, and freestyle swimming. If standing still is not possible, explosive movements are also difficult to perform. This is demonstrated in the long jump where an athlete may have good speed but the height from the board is poor and subsequently the distance covered is rather limited.

FIELD
Throwing events require explosive movement. For the same reason as in track, athletes with athetosis have difficulty demonstrating explosive power. This is particularly obvious in shot-put. Athletes with ataxia demonstrate these problems to a lesser extent.

Class C7
The Class 7 athlete is ambulatory with hemiplegia. The individual has Spasticity Grade 2 to 3 in one half of the body. They walk without assistive devices but often with a limp due to spasticity in the lower limb. Good functional ability in dominant side of the body.

Lower Extremities:
Hemiplegia Spasticity Grade 2 to 3. Dominant side has better development and good follow-through movement in walking and running. Moderate to minimal athetoids do not fit into this class.

Upper Extremities:
Arm and hand control is only affected in the non-dominant side. There is good functional control on the dominant side.

Class C8
The Class 8 athlete has minimally affected diplegia/hemiplegia and/or minimally affected athetosis. Spasticity Grade is 1 to 2. They are able to run and jump freely without a limp, without modifications of footwear or orthoses. They may have minimal loss of function caused by lack of coordination, usually seen in the hands, perhaps a slight loss of coordination in one leg or minimal shortening of the Achilles tendon.

Les Autres (excluding amputees, medullar lesions and CP – as presented by the International Sports Organization for the Disabled [ISOD])

Class L1
Severe involvement of all four extremities. Examples: Severe cases of multiple sclerosis.

Muscular dystrophy. Juvenile rheumatoid arthritis with contractions, etc.

Class L2
Severe involvement of three or all four extremities whose limitations are less severe than those of Class L1. Examples: Severe hemiplegia. Paralysis of one extremity with deformation of two other extremities. Less severe cases of multiple sclerosis and comparable diseases.
**Class L3**
Limited functioning of at least two extremities. Examples: Hemiparesis. Hip and knee stiffness in one member with deformation of one arm.

**Class L4**
Limited functioning in two or more extremities. These limitations must be less than in Class L3. Examples: Contractions or ankylosis/orthodesis (stiffness or fixation of a joint) in the joints of one member with limited functioning in the other.

**Class L5**
Limited functioning of at least one extremity or comparable disability. Examples: Contractions of ankylosis of hip or knee joint. Paresis in one arm. Cyphoscoliosis.

**Class L6**

**Amputees** *(as presented by the International Sports Organization for the Disabled [ISOD])*
This classification system includes only athletes with acquired or congenital amputations.

- **AK** - Above or through the knee joint
- **BK** - Below the knee, but through or above the talo-crural joint
- **AE** - Above or through the elbow joint
- **BE** - Below the elbow, but through or above the wrist joint

**Class A1**
Double AK - Both legs amputated above the knee.

**Class A2**
Single AK - One leg amputated above the knee.

**Class A3**
Double BK - Both legs amputated below knee.

**Class A4**
Single BK - One leg amputated below the knee.

**Class A5**
Double AE - Both arms amputated above or through the elbow joint.

**Class A6**
Single AE - One arm amputated above or through the elbow joint.

**Class A7**
Double BE - Both arms amputated below the elbow, but through or above the wrist joint.

**Class A8**
Single BE - One arm amputated below the elbow, but through or above the wrist joint.

**Class A9**
Combinations of amputations of the upper and lower extremities
**International System**

During international competition, the above classes are organized into a single system with the prefix “T” for track and “F” for field (International Paralympic Committee guidelines).

### Track Events for Blind Athletes
- **T-11** – Class B1
- **T-12** – Class B2
- **T-13** – Class B3

### Track Events for Athletes with Cerebral Palsy
- **T-31** – Class C2 lower, wheelchair
- **T-32** – Class C2 upper, wheelchair
- **T-33** – Class C3, wheelchair
- **T-34** – Class C4, wheelchair
- **T-35** – Class C5, ambulatory
- **T-36** – Class C6, ambulatory
- **T-37** – Class C7, ambulatory
- **T-38** – Class C8, ambulatory

### Track Events for Ambulatory Athletes
- **T-40** – Not used
- **T-41** – Not used
- **T-42** – Class A2 (A9)
- **T-43** – Class A3 (A9)
- **T-44** – Class A4 (A9), LAT3
- **T-45** – Class A5/A7
- **T-46** – Class A6, A8, LAT4

### Track Events for Wheelchair Athletes
- **T-50** – Class C2
- **T-51** – Class T1
- **T-52** – Class T2
- **T-53** – Class T3
- **T-54** – Class T4
- **T-55** – Class T5

### Field Events for Blind Athletes
- **F-11** – Class B1
- **F-12** – Class B2
- **F-13** – Class B3

### Field Events for Athletes with Cerebral Palsy
- **F31** – Not Used
- **F32** – Class C2 upper, wheelchair
- **F33** – Class C3, wheelchair
- **F34** – Class C4, wheelchair
- **F35** – Class C5, ambulatory
- **F36** – Class C6, ambulatory
- **F37** – Class C7, ambulatory
- **F38** – Class C8, ambulatory

### Field Events for Ambulatory Athletes
- **F40** – Dwarf Athletes
- **F41** – Not Used
- **F42** – Class A2 (A9), LAF5, F8
- **F43** – Class A3 (A9), LAF5, F8
- **F44** – Class A4 (A9), LAF5, F8
- **F45** – Class A5/A7
- **F46** – Class A6, A8, LAF6

### Field Events for Wheelchair Athletes
- **F51** - Class F1, LAF1, CP2
- **F52** - Class F2, LAF1, CP2, CP3
- **F53** - Class F3, LAF2, CP3
- **F54** - Class F4, LAF3, CP3, CP4
- **F55** - Class F5, LAF3, CP4
- **F56** - Class F6, (A1)(A9), LAF3, CP4, CP5
- **F57** - Class F7, (A1), (A9), LAF3
- **F58** - Class A2, A3, (A9), LAF3, F8, (LAF4)
PLANNING A TRAINING SESSION

A training session consists of four sections:

Introduction of session goals – The coach begins each training session by sharing the day’s training objectives and how these objectives will be achieved. It’s important that the coach share this information so that athletes are aware of and able to focus on the skills being trained.

Warm-up/stretching – Warming up and stretching are important to prepare athletes both physically and mentally for training.

Presentation of content or learning activities – This section contains the day’s workout. It is prepared before practice time so that the content is relevant to session goals and practice time is efficiently used. Content is varied daily to avoid staleness in training.

Cool down/stretching – The cool down enables a quicker recovery before the next training session.

Warm-up

Every training session must begin with a warm-up. A warm-up is important because it prepares athletes both mentally and physically for the major work to be done later in the training session. More specifically, a warm-up (Allerheiligen, 1994):

- stimulates the activity of the central nervous system, which improves the coordination of the body’s systems and speeds up motor reactions
- increases heart rate, blood flow, respiration rate, and perspiration
- elevates body temperature to reduce the risk of injury to muscles, ligaments, and tendons

A warm-up is usually divided into two phases: the general warm-up and the specific warm-up. The general warm-up consists of 10 minutes to 15 minutes of low intensity exercise, for example slow jogging or riding a stationary bicycle, to prepare the body for oxygen delivery to working muscles. A short period of light stretching follows to stimulate the muscle stretch receptors. The specific warm-up is used as a short transition into the workout. Athletes perform a few efforts at high intensity, simulating the movement to be trained during that day’s session. For instance, athletes would perform a few short all-out accelerations in a sprinting session, or would perform a few repetitions of a squat in a strength training session (Publow, 1999).

Cool down

A cool down is as important as a warm-up and closes every training session. A high amount of lactic acid can build up in the muscles and the blood during training, causing athletes to feel fatigued and sore. Ten minutes to 20 minutes of low-intensity exercise can remove about half of the lactic acid from the system (Bompa, 1999). As a result, athletes will experience a quicker recovery between training sessions.

Stretching

Eight minutes to 10 minutes of stretching is performed following the general warm-up before all training sessions and competitions. Stretching not only assists in preparing the muscles for the workout, it also assists in injury prevention by stretching muscles, muscle sheaths, and tendons (Curtis, 1981). An additional 10 minutes of stretching follows the cool down while the muscles are still at an increased temperature. Stretching is essential to increasing range of motion (ROM), or the degree to which a joint can move through the full range of possible movement. An increased ROM not only assists in injury prevention, but can also heighten athletic performance.
Stretching can be either active or passive. Active stretching occurs when the athlete stretching applies the force for the stretch him or herself. Passive stretching occurs when a partner or device provides the force for the stretch.

It’s important to note that athletes must stretch only to the point of discomfort. Stretching does not increase flexibility if it causes pain. Pain, in fact, is more likely to result in damage to muscle or connective tissue.

Furthermore, some athletes may have joint contractures, fusions, rods, a high degree of spasticity, or a propensity for fractures that may restrict ROM and demand careful stretching (Millikan et al., 1995). Check with athletes or their parents for any such disability-related concerns before beginning a stretching program.

**Basic Skills and Progression**

**Wheelchair Track**

The recommended stroke technique for classes T52, T53, and T54 is the Illinois Para-Backhand technique. The Illinois Para-Backhand was developed primarily to reduce the injury rate that resulted from the stress placed on wrists, elbows, and tendons when using other techniques. At the same time, it was developed to increase contact adhesion and stability. The technique is broken down into five phases. In each phase, the hand interfaces with the hand ring at a different location. For instructional purposes, the hand ring will be discussed as if it is a clock face. The right hand ring is viewed as a standard clock face, and the left hand ring is viewed as a clock face’s reflection. The hand is closed in a relaxed fist with the thumb pressed into the side of the index finger during each of the phases.

*The Catch (Figure 4A)*

Initial contact with the hand ring is made between the index and middle fingers. The wrist is flexed toward the thumb while the thumb presses against index finger to ensure stability. It’s critical that initial contact is made correctly because it dictates the effectiveness of the remainder of the stroke. The point on the hand ring contact is made varies according to speed. Generally, contact will be made between 1:00 and 1:30 at speeds less than 12 mph; contact will occur progressively later on the hand ring as speed increases.

*The Drive (Figure 4B)*

The motion of the drive phase is defined by a powerful squeezing in on the hand rings by the arms while the hands drive around and accelerate the hand ring. The hand drives into ring from initial contact with the wrist still flexed toward the thumb until around 3:00. Arriving at 3:00, the flex of the wrist shifts powerfully and quickly toward the pinky finger, causing the hand to act like a whip and deliver tremendous power and acceleration. The contact with the hand moves from between the middle and index fingers down to their cuticles and the thumb’s base. The hand continues to drive until 5:00 or 7:00.
**The Release (Figure 4C)**
The wrist should be completely flexed toward the pinky finger during the release. The hand maintains its line of movement as it comes off hand ring and does not snap away. The release occurs around 5:00 to 7:00

**Lift and Stretch (Figure 4D)**
The elbows are forcefully lifted up and back until they reach an optimal stretch. At this point, a stretch reflex will occur in the chest and rear shoulder muscles, causing the stretched muscles to powerfully contract.

**Acceleration (Figure 4E)**
The stretch reflex initiates a powerful descent by the arms toward the hand ring, almost like a coiled spring that is let loose. The wrists position themselves once again for initial contact by flexing toward the thumb

For class T-51 quadriplegic racers, the recommended stroke technique is the Quadriplegic Backhand. The hand is positioned at the beginning of the stroke so that the back of the hand is facing the hand ring. Contact is made with the back of the hand between the knuckles and the wrist. As the arms are extended and downward motion is initiated on the front of the hand rim, the hands and forearms turn upward. At the same time, the hand ring is wedged between the last two fingers and force is applied with wrist and elbow extension. This contact and force application continues until the elbows are fully extended, after which the hands are pulled upward with the biceps while remaining in contact with the hand ring (Morse et al., 1995).

**Wheelchair and Ambulatory Field**

Wheelchair and ambulatory field technique share many of the same principles. Because of this, the instruction following combines the two while noting differences when necessary. Max Jones (1994), national coach for England, defines shot put, javelin, and discus technique by five common root movements:

1) Legs or hips/torso first, arms last: Athletes should use larger muscles to accelerate the implement, with the smaller arm muscles being used as late as possible.
2) Extension: The implement always is released from a stretched, high position.
3) Left side brace: The left side must be braced to allow the right side to accelerate around it.
4) Torque: The hips lead the upper body to create a spring-like action.
5) Rotation: Athletes must have the ability to rotate.

Bear in mind that the athlete’s functional level will influence the performance of the above movements. For instance, it may not be possible for quadriplegics and high-level paraplegics to achieve any rotation.

Each implement’s flight range is determined by three factors: speed of release, angle of release, and height of release (Paish, 1994). The discus and javelin may also be influenced by aerodynamics.

These root movements and flight-range factors should guide field athletes as they learn proper technique.

Before beginning instruction in specific throws, it’s recommended that the coach start with the following basic movements (Maltseva, 1994):

1) Athletes take a throwing position in which the left shoulder leads (for right handed throwers).
2) The trunk turns forward toward the throwing direction before the arm action begins.
3) A sufficiently high delivery angle is used to increase throwing distance.
4) Arm speed is continual because the implement and the hand holding it move at the same velocity.

The instruction that follows is presented for an athlete who throws with the right hand.

**Shot Put**

*The Grip (Figure 5)*

The shot is held as high as possible on the fingers while still allowing control. The higher it’s held, the better and quicker the release. Holding the shot on the palm and rolling it up onto fingers before or at release is acceptable, but such technique takes a lot of practice. The number of fingers placed on the shot can be three or four, depending on preference. If three are used, the pinky finger curls down alongside the shot to stabilize and guide. For both three and four, the thumb placement below the shot determines the height of the shot on the fingers.

Quadriplegics hold the shot balanced in the palm of the hand with the fingers and thumb providing as much support as is possible to assist in balance (Morse et al., 1995).

*Shot’s position on neck*

This position replicates hand’s position at release: the thumb is down and the elbow is up away from the torso. The elbow assumes this position in order to apply an acceptable amount of pressure against the neck to hold the shot in.

*The Glide (Figures 6A-6D)*

The free arm’s position at the beginning of the throw depends on functional ability. For ambulatory athletes, the free arm hangs loose and relaxed in a vertical position; for wheelchair athletes, the free arm is either positioned horizontal to the ground with a slight bend in the elbow or grasps a bar on the throwing chair. During the glide, the free arm and shoulder open slightly as a natural reaction while the shoulder and arm holding the shot stay back. The path of the shot going through the putting motion creates a slight “s”. Most ambulatory athletes begin the glide with a powerful lift of the left leg up and forward and a drop of the trunk so the back assumes a horizontal extension. Following, the right leg flexes and drives the body forward and settles into a slightly flexed position. Once the right leg has finished its drive, the left leg is placed near the ground by the toe board. The body’s weight is over the right leg, now at the circle’s center.

Polio athletes and single above-the-knee amputees often begin the glide with their left leg already planted hard against the toe board.
The Put (Figures 6E-6H)

The forward rotation of the torso/hips takes place and creates an upward explosion. Simultaneously, the free arm, hanging loose and relaxed in a vertical position, opens and straightens to become parallel with the shoulders. As the weight shifts forward, the elbow of the free arm bends and shortens the radius of the free arm. The chest locks out from the shortening of the free arm’s radius, causing the shot to pull away from the neck toward the putting shoulder. Once the hips are square or the lead leg fully extends, the free arm’s rotation stops, which blocks the left hip’s rotation and transfers power to the body’s right side. The shot is accelerated quickly during the power transfer and the throwing arm simply tries to keep up with the shot. The thumb is positioned down at the shot’s release and the wrist and fingers attempt to provide a great amount of snap for a final burst of speed. The ideal angle of release is at 39 degrees to 40 degrees.

The Follow-Through

The follow-through is simply the natural following of the throwing arm across the body after the shot is released.

Discus

The Grip (Figure 7)

The discus is held flat against the hand, and its circumference rests on the last joints of the fingers. The fingers are spread apart with the thumb being placed on top of the discus for greater control. The upper face of the discus may touch the arm because of the slight bending at the wrist. This grip will vary for each athlete in some degree according to hand size. As the athlete becomes proficient, the discus can be held more loosely in the hand.
**Preliminary swing (Figure 8A)**

The preliminary swing or swings establishes the rhythm of the throw, overcomes the inertia of the discus, places the discus as far behind the body as is controllable, and gives the body the maximum range of movement. They are performed in a relaxed and smooth flowing manner. The discus is swept through the widest orbit around the body and as far back as possible. Wheelchair athletes begin the preliminary swing with the discus supported at the left side around shoulder level. The discus is sandwiched between both hands with the right hand on top. A preliminary swing backward to the right side is taken, followed by a forward preliminary swing to the left side. During these swings, the hands continue to sandwich the discus (in the back swing, the throwing hand can sit palm up to make holding onto discus easier). During the final swing backward toward maximal rotation, the left hand leaves the discus (Morse et al, 1995). Quadriplegics and higher-level paraplegics may be unable to use the sandwich technique, in which case, the left arm holds onto the throwing frame during the preliminary swing.

![Image](image.png)

**Delivery (Figure 8B-8C)**

At the terminal point of the back swing when maximal rotation is achieved, the waist bends forward slightly and the weight transfers over back leg. The right arm is held high and as far back as possible while the left arm wraps around the front of chest. The delivery starts as the left elbow extends and swings to the left horizontally until the hips are halfway turned forward. At this point, the left arm shortens and places the chest in a stretched position to provide maximum power. Meanwhile, a split second after left arm starts moving, either the legs and hips (ambulatory) or the hips and torso (wheelchair) drive forward, upward or around, dragging the discus behind. When the hips and shoulders are facing forward, the right arm moves forward to release the discus, which is elevated to around shoulder level and is flat.

**Release (Figure 8D)**

During release, the discus rotates clockwise out of hand, exiting off the index finger. It’s critical to release the discus with a smooth spin in order to stabilize the discus in flight. The angle of release should be around 40 degrees.

**The Reverse (Ambulatory)**

At release, the feet are reversed to prevent fouling at the front of the circle and to regain balance. The right foot moves forward and bends slightly to absorb the contact with the ground.
Javelin

The Grip

There are two basic options when holding the javelin.

1) The javelin is positioned along the inner edge of the palm and the thumb, and the last two joints of the index finger rest off the edge of the cord.

2) The thumb and the last two joints of the middle finger rest off the edge of the cord, while the index finger supports the javelin from below (Figure 9). In both grips the javelin is held in semi-relaxed fashion.

For quadriplegics, the javelin is lodged within the heel of the hand to create maximal friction between the hand and the cord. The javelin should be lodged in such a way as to ensure it sits in line with the direction of the throw (Morse et al., 1995).

Ambulatory Technique

The Carry

The javelin is carried above the shoulder at forehead height with the point either slightly up or slightly down.

The Run-Up

The goal of the run-up is to deliver the javelin with as much forward velocity as possible. This goal is not through running up faster, but rather by having optimal control in the final throwing position. That is, through the feet being on the ground at the right time and the right place to produce optimal body torque. The first two-thirds of the run-up is an accelerating run, which is then followed by a stride rhythm. A widely accepted stride rhythm is the five-stride rhythm, which consists of four phases.

The withdrawal phase is initiated by a preliminary stride by the left leg. The phase begins at the second stride and finishes at the third stride. As the preliminary stride begins, the right arm moves backward horizontally to the shoulder axis. The forearm is extended by the upward rotation of the palm (Figure 10A).

The impulse phase consists of one stride. The hips turn at a 20-degree angle to the right while the right foot turns to a 30-degree angle. The right leg moves under the body and is placed in front of the athlete. The left leg keeps the body low in order to keep its center of gravity back (Figure 10B).
The throwing position is achieved when the left leg has completed its stride and made contact with the ground. At this point, the right leg is supporting the body's center of gravity. The longer the left leg's stride is, the later the right leg can begin to extend. Arm and javelin position are the same during the impulse stride and throwing position. The wrist should not be flexed, but rather should maintain full extension (Figures 10C-10E).

During the release, the right hip is driven forward by a forward and upward movement of the right leg. Hip rotation starts slow and relaxed to aid in control of the throwing angle and to allow time for the hip rotation to couple with upper body rotation. The chest is rotated and the back is placed in a considerable concave arch. As the shoulders rotate, the throwing arm stays back parallel to the runway, so that it is trailing the body's rotation. The shoulders square, and the chest and the action of the back snapping back into normal position accelerate the throwing arm forward, called body whip. The elbow is raised in until it is level with the head and points in the direction of the throw, creating a right angle between the upper and lower arm. The angle of release is between 32 degrees and 36 degrees (Figures 10F-10I).

To avoid fouling, a recovery stride is taken in which the right foot is placed crosswise to the throwing direction. The upper body leans forward and the left leg is raised and brought backwards (Figure 10J).

**Wheelchair Technique**

**Sitting position**

The athlete can either sit facing straight ahead or at a slight angle to the direction of the throw. Sitting position is dictated by muscle function and hand hold of the free hand.

**Throwing**

*From a slight-angle sitting position:* The right hand begins a few inches in front of the body with the javelin point slightly above the right ear and pointing forward and slightly upward in the throwing direction. The right hand, palm facing up, extends to the rear and rotates the body to the right. The left arm either holds onto the chair or is used to initiate forward movement of body
and throwing arm. The rotation forward starts slow and relaxed to aid in the control of the throwing angle and to allow time for the hip rotation to couple with upper body rotation. The chest is rotated and the back is placed in a considerable concave arch. As the shoulders rotate, the throwing arm stays back, so that it is trailing the body's rotation. The shoulders square, and the chest and the action of the back snapping back into normal position accelerate the throwing arm forward, creating body whip (Morse et al., 1995).

From a straight-ahead sitting position: The right hand begins a few inches in front of body with the javelin point slightly above the right ear and pointing forward and slightly upward in the throwing direction. The right arm is extended backward as straight as possible with the body leaning back and the back arching. As the body moves forward, the arm is thrust close to the head toward the release (Morse et al., 1995).

**The Release**

The javelin angle at release is controlled primarily by the wrist. With the throwing arm slightly above the horizontal plane of shoulders, the point of javelin is placed at the jaw line of the athlete and almost touching it. The head is slightly tilted in front of body’s plane. The wrist bends as the arm travels past the shoulder to maintain the 32 degrees to 36 degrees angle of release (Morse et al., 1995).

**The Follow-Through**

The arm and torso follow the momentum initiated by the forward thrust in the direction of the javelin's flight.

**Ambulatory Track**

Because of the manual's wide application, fundamental skills taken from able-bodied running technique will be presented. Certainly, the applicability of able-bodied technique will vary according to functional ability. But with an understanding of able-bodied running mechanics combined with an understanding of the functional potential of the athlete, the coach will better be able to assist in achieving sound technique. Special mention will be made for amputee athletes when necessary.

**Fundamental Running Mechanics**

There isn't one universal correct running form. Form largely depends on the athlete; i.e., body dimensions, strength, prosthesis fit, flexibility, etc. However, in a general sense there are certain components that constitute appropriate form. The running action of each leg can be divided into three phases:

**Support Phase** *(Figure 11A depicts the support phase for the left leg; Figures 11I-11J depict the support phase for the right leg)*

The supporting phase is the shortest of the phases and begins when the foot makes contact with the ground. Contact is made around 12 inches in front of the point directly below the body’s center of gravity. The foot should land on the outer border of the ball of the foot, which is followed by the heel contacting the ground with an inward rolling of the foot. The phase ends when the body's center of gravity passes ahead of the foot contacting the ground.
Driving Phase (Figures 11B-11D depicts the drive phase for the left leg)

Once the supporting phase ends, the body is driven forward by an extension beginning at the hip and followed by the knee, ankle, and toes that act behind the body’s center of gravity. If the athlete is correctly driving forward, it should feel as though s/he is pushing the ground away from behind. As the body moves past the foot, the heel is lifted off the ground. The driving phase is complete when the inside edge of the ball-toe of the foot leaves the ground.

Recovery Phase (Figures 11E-11J depicts the recovery for the left leg)

The recovery phase occurs from the time the toe of foot in the driving phase leaves the ground and to the time it returns to the ground to begin the supporting phase. The height of the knee lift during the recovery phase depends on speed; the faster the running speed, the greater will be the knee lift. The forward swing of the recovery knee should terminate when the opposite leg completes the driving phase. Then the recovery foot sweeps down to begin the supporting phase.

Other factors to be considered in running technique are:

a) Body Lean – is a function of acceleration; with more acceleration comes more body lean; for example, at starts more body lean is evident because more acceleration is taking place, in contrast to uniform speed where the body is almost erect because of no acceleration

b) Stride frequency – sprinters will have greater stride frequency than endurance runners

c) Stride length – generally, stride length is a function of running speed; slower speeds exhibit shorter strides and faster speeds exhibit longer strides; however, it is critical not to over or under stride; appropriate stride length is quite individualized, but keep in mind that a greater stride length is achieved through a more powerful drive, and not by overstretching the lead foot or leg

d) Together, stride frequency and stride length equal running speed

The above principles are the same for sprinters and distance runners. As athletes begin to master these basic skills, the coach must begin to specifically address sprinting technique and controlled speed technique.
Sprinting

The Start

The purpose of the start is to accelerate to maximum speed in the least amount of time. The starting blocks are generally placed with 10 inches to 18 inches separating them and set two and a half feet from the starting line. Their exact placement will vary according to athlete's body type and preference. The front block’s pedal angle is set at 55 degrees to 60 degrees, and the rear block’s pedal angle is set at 80 degrees to 85 degrees. The angles are set in such a way as to allow an angle of around 90 degrees to form between the thigh of front leg and trunk, an angle of 90 degrees to form by the knee joint of front leg, and an angle of 120 degrees to 130 degrees to form by the knee joint of rear leg. The arms hang directly under the shoulders at shoulder width apart and at a 90-degree angle to the track surface. The weight is evenly distributed between hands and the feet and the eyes are focused 3 feet to 5 feet in front of the starting line.

Set

In the set position, the hips are raised above the shoulders causing a downward slope to the back and achieving a 130-degree angle bend in rear leg. The shoulders move forward slightly ahead of the hands and the front knee is bent at around a 90-degree angle. The head is either in natural alignment with the shoulders and the eyes focused slightly ahead of starting line, or it is elevated with eyes focused down the track. The toes of the back foot are set firmly against the starting block.

The manner by which the amputee athlete gets into a starting and set position largely depends on functional level. Using starting blocks as an able-bodied sprinter would is conducive for single leg below-the-knee amputees because they can achieve an effective interface between their normal foot and the starting block. The prosthetic leg, however, cannot achieve a similarly effective interface, and therefore it’s less effective for a double amputee, whether above or below the knees, to attempt to use starting blocks in this way. Furthermore, a double amputee will have more difficulty achieving an effective starting and set position with a standard starting blocks set-up because of limitations in the prostheses. Such athletes and their coaches need to be creative in discerning which position will allow for the greatest acceleration.

Starting Action

The goal of the starting action is to achieve the greatest acceleration from a dead start, irrespective of functional level. The hands are picked up and the shoulders raised as the hands move in opposite directions – one forward and up, the other backward – in a short and powerful action. At the same time, the legs make an initial drive against the starting blocks (or ground). The rear leg then pulls through and the front leg exerts its maximum force until the knee and ankle joints are fully extended and the foot leaves the block pedal (or ground). The body takes on a pronounced lean to create a straight line from the lead foot through the leg, hips, trunk, shoulder, and head at a 30-degree angle from the ground. The rear leg touches the ground under or slightly behind the body’s center of gravity.

Sprinting Action

During the driving phase, the driving foot provides a forward thrust. After that foot’s toes leave the ground, the thigh begins an accelerating swing forward and then upward. This movement increases the ground reaction force, thereby increasing the speed that the body’s center of gravity moves away from the supporting foot. After maximum height is reached with the knee, the thigh and knee descend and the foot and fore leg continue unfolding and extend forward before they begin moving downward and backward. The foot strikes the track under the center of gravity and must then move back faster than the center of gravity is moving forward.
The arms should be relaxed when sprinting and stay at a 90-degree angle. The body's forward lean exhibited during the start will be reduced as the length of time spent applying force to the track is reduced and the supporting leg moves closer to being placed directly under the body's center of gravity.

The amputee runner should attempt to use his or her functional muscle mass to simulate an able-bodied sprinting action as close as is possible. For above-the-knee amputees possessing less functional mass, this is a more difficult task. A variation of the able-bodied technique designed for such amputees is called the "Leg-Over-Leg" technique.

"Leg-Over-Leg"

The recovery phase for the prosthetic leg in this technique is normal, and it takes a full stride. When it strikes the ground, it will initially cause the runner to slow down, but this deceleration is quickly overcome by using hip extension. The hip extension assisting in the prosthetic leg's supporting and driving phase causes the recovery phase of the sound limb to typically be shorter than the prosthetic leg's stride.

Maintaining Velocity

Studies have shown that elite able-bodied sprinters reach maximum speed at five seconds to six seconds and are able to sustain that speed or within 1 percent of that speed for only between 20 meters and 40 meters. So, assuming equal acceleration and maximum velocity, the runner who slows down the least will be the winner.

The Gather and Finish

The gather is a mental preparation to burst for the tape and begins 20 yards from the finish. At that point, the runner takes a deep breath, gets higher on the toes to achieve longer strides, and reaches high with the arms for extra length. This is done in a relaxed fashion, with the head down and eyes on the finish line. A powerful drive through the tape should take place as if the finish line is five yards beyond.

Endurance

A very effective running technique for endurance runners is called the rolling stride. Its purpose is to provide a highly efficient and economical running technique. The following aspects should be considered:

1) A medium effort level is used in the driving phase, along with optimal extension of the hip, knee and ankle joints.
2) In the recovery phase, the leg moves in a relaxed manner. In contrast to sprinting, the lower leg should not fold in toward the thigh because such action is not economical and will quickly lead to fatigue.
3) The knee should be lifted to a medium height during the recovery phase.
4) At the end of the recovery phase and before the foot strike, the foot should be lifted. This lift minimizes the natural breaking forces existing during initial contact with the track.
5) The arms move in a coordinated effort with the legs. The shoulders are relaxed in their forward movement, and they slightly lift during their backward movement. The arms do not move across the body.
6) The hands are relaxed and the thumb rests on the second joint of the middle finger. They move in a straight line from the middle of the body back to the side of the hips.
7) The upper body should be held upright and take on a slightly forward lean.
8) Breathing is done in rhythm with the running, inhaling and exhaling through a partially open mouth and through the nose.
9) The slower the race, the shorter the stride length; the longer the race, the longer the stride length.
10) The face muscles are relaxed.

**Long Jump**

The long jump is divided into four phases:

1) approach;
2) take off;
3) flight position; and
4) landing.

**The Approach**

The critical factor concerning the approach is the speed athletes reach. A speed that is 85 percent to 90 percent of maximal should be targeted. Such a percentage allows athletes to achieve an adequate upward lift during takeoff, which cannot be achieved from maximum speed.

**The Take Off**

The preparation for take off begins during the three to four strides before reaching the take off board. Athletes relax and slightly flex the leg on the final stride (called the take off leg). The take off leg drives off the take off board while the opposite leg’s knee drives upward. Simultaneously, the chest, shoulders, and head are held high and the arms are used to balance the body.

**The Flight Position**

The goal of the flight is to keep the legs in the air as long as possible. After take off, athletes first arch the back and keep the chest and head up, which assists in getting sufficient height. Following this movement, there are several techniques that assist in prolonging the time the feet are in the air, the most basic called the sail. The sail position is achieved by vigorously pulling the take off leg forward so that it is placed evenly with the opposite leg. Both legs are partially bent and the heels are carried at a level equal to the hips. The head, chest, and arms are held high by a trunk that assumes an upright position.

**The Landing**

The goal of the landing is to achieve a position that precludes the athletes from landing and falling backward in the pit, thus shortening their jump distance. The legs are extended forward as far as possible with the toes up. The arms, head, and chest drive forward and downward at the same time to keep the hips forward. Upon making ground contact with the heels, the knees relax. Athletes should fall forward and assume a tucked position.

**High Jump**

The high jump can be divided into three phases:

1) approach;
2) take off; and
3) clearance and landing.
The Approach

The approach generally begins with two to three easy walking strides followed by seven to nine hard strides, during which athletes achieve the necessary speed to clear the bar without compromising the control of the limbs necessary for a successful jump. Athletes who jump off their right foot approach the bar from the right at a 45-degree angle, and athletes who jump off their left foot approach from the left at a similar angle. After the initial strides toward the bar, athletes begin to gather themselves in their final three strides, which become progressively longer, and drop into a slightly crouched position. The crucial backward lean of the body is achieved in the final stride by an extension forward of the take off foot.

The Take Off

From the backward lean position, athletes swing the lead leg forward and up. This action assists in pulling the body over the take off leg, which drives off the ground. At the same time, the arms also swing up and are partially bent and accompany a vertical extension of the trunk. Very important is that the ankle of the take off leg be fully extended to achieve maximum drive. Additionally, the lead leg must drive up to waist height and rotate away from the bar.

The Clearance and Landing

Critical to successful clearance is relaxation of the body. The lead leg falls back from waist height to assume a similar position of the take off leg, and the arms maintain close contact with the body. Once the shoulders have cleared the bar, the hips are moved forward forcefully to clear the pelvis across the bar. Just as quickly, the hips move backward after the pelvis clears the bar. This hip movement is assisted by pressing the chin against the chest. As the body continues falling backward, the legs move upward, fully clearing the bar with a quick vertical extension of the calves. In preparation for landing, the body tenses into an “L” position. The hands are spread outward to make initial contact and absorb the landing shock.

Preparing Ready for Competition

Preparing a Team for Competition

The coach’s goal is to create an environment where the athlete can maximize his or her potential. To do that, the athlete must be spared from having to waste energy that should be used for competing. That means coaches and support staff must take care of logistical concerns and address any external variables that might sway the athlete’s focus from competing. The coach must account for all of the conditions surrounding the competition, and then make certain the athlete is aware of these conditions. Preceding the 1988 Olympic Games, Great Britain’s Frank Dick (1987) compiled the following list of conditions coaches and support staff must account for (not all of the conditions apply all of the time):

Venue: Know the time change, altitude change, daily maximum and minimum temperature during competition times, wind speed and direction, rain patterns, humidity levels.

Accommodations: Know the number of athletes housed in each room, all details regarding storage accommodations for equipment, whether hotel facilities are accessible, whether the venue has on-site accessible bathrooms, whether water and food are provided on site.

Transportation: Know what the distance from the venue to the hotel is, what the traveling time to and from the venue to the hotel is, whether transportation is accessible.

Medical: Know if on-site medical services are provided and where the nearest hospital is to the venue and the hotel.
**Competition organization**: Know what the warm-up arrangements are; when athletes are allowed to warm up; how long they are allowed to warm up; if the track is shared by ambulatory and wheelchair athletes; which lanes are allocated for ambulatory and which are allocated for wheelchairs; how the athlete will be called to the events; how long it will be between first call, final call, and the event; where the staging area is. The coach should get a copy of the schedule and review with the athletes what time they compete, when to begin the warm-up, and when they will be called.

**Opponents**: Know and review with athletes their opponents’ strengths and weaknesses and what they need to do tactically to address opponents' strengths and weaknesses.

**Food**: Know where the nearby restaurants and grocery stores are. The night before competition, the coach and support staff should review the following day’s schedule with each athlete, which should already be mapped out in a manner such as:

- 7:00 a.m. - wake-up call
- 7:30 a.m. - meet for breakfast
- 8:00 a.m. - leave for the track
- 8:30 a.m. - check in if necessary
- 9:30 a.m. – warm-up
- 10:00 a.m. - event time

**Selecting Athletes**

It is recommended that the head coach provide each athlete with a code of eligibility form to be followed in order to be eligible for competition. The code of eligibility form should be prepared before the season, and then presented at the first meeting or practice. Each athlete must take a copy, read and sign it, thus agreeing to follow the rules of eligibility.

The head coach should consider the following criteria when designing a code of eligibility:

- **Compliance** – Athletes must show up for practice and be on time. The coach must determine the number of allowable excused and unexcused absences based on the total number of practices to be held. A time limit should be set from the beginning of practice, for example 15 minutes, after which any athlete not present will be given an unexcused absence. If athletes have to miss a practice, they should call beforehand.
- **Drugs, alcohol or smoking** – Taking unauthorized drugs, stimulants, or other drugs characterized as dope by athletes with the intent to improve performance or any other purpose is unacceptable. Drinking or smoking during participation of team-related activities is also unacceptable.
- **Personal Hygiene** – Wheelchair athletes should keep their racing wheelchair and everyday wheelchair upholstery clean, and keep cushions and covers clean. All athletes should wear fresh clothing for each workout, shower with soap daily, and maintain good oral hygiene.
- **Self sufficiency** - Athletes with incontinence must be able to attend to their own bowel and bladder regulation.
- **Behavior** – Athletes must maintain the highest standards of sportsmanship. This includes self-control and responsible behavior, consideration for the physical and emotional well-being of other athletes, and courtesy and good manners while training and traveling.
- **Equipment** – Athletes must show respect to their equipment by taking proper care of it. Any necessary maintenance must be done as soon as possible.
Selecting Appropriate Competitions

Competitions should be selected that are progressively more difficult and pit athletes against more talented opponents. This is done to challenge the athlete a little more each competition and prepare for the peak competitions.

In the early part of the season, competitions are selected that allow athletes to test a specific skill (a new throwing technique, for example) in competition and to try different events and race strategies. During mid to late season, competitions are selected that allow athletes to compete against exceptional opponents. The goal at these competitions is to achieve a high finish, but athletes should not be concerned about achieving a peak performance. Peak performance occurs in the late season, during which regional, state, national, and international meets are selected.

Additionally and especially for qualifying meets, it is crucial to know the venue. The weather patterns and forecast, the meet’s past and potential organization level, and significantly for track athletes, the track surface should be known. A softer surface that is conducive to faster times for ambulatory athletes is not so for wheelchair athletes, who instead need a firmer surface such as mondo or asphalt. If possible, past results from the venue should be checked. Other coaches, athletes and organizers can also be asked to discover where the fast tracks are located.
OFFICIAL COMPETITION RULES

Disabled track and field is comprised of five disabled governing organizations (DSOs). Each DSO can be contacted for an official rulebook covering its disability group.

Wheelchair Track and Field
Wheelchair Sports, USA 3595 E. Fountain Blvd., Suite L-1 Colorado Springs, Colorado 80910
USA 719-574-1150 http://www.wsusa.org/

Ambulatory Track and Field
Disabled Sports USA 451 Hungerford Drive,
Suite 100 Rockville, MD 20850 1-301-217-0960
http://www.dsusa.org

Cerebral Palsy/Brain Injury/Stroke

Blind/Visually Impaired
United States Association of Blind Athletes 33 N. Institute St. Colorado Springs, CO 80903
Phone: (719) 630-0422 http://www.usaba.org/

Dwarf
Dwarf Athletic Association of America 418 Willow Way Lewisville, TX 75077 Phone: (972) 317-8299 http://www.daaa.org

International Blind Sports Federation
Jose Ortega y Gasset, 18 28006 –
Madrid (Spain) http://www.ibsa.es/eng/

International Stoke Mandeville Wheelchair Sports Federation
Head Office Olympic Village, Guttman Road Aylesbury Bucks HP21 9PP UK Phone: +44 (0) 01296 436179 http://www.wsw.org.uk/

Cerebral Palsy International Sports and Recreation Association
Secretariat CP-ISRA Trudie Rombouts PO Box 16 6666 ZG HETEREN The Netherlands Phone: 00 31 32 64 72 22 593 http://www.cpisra.org/

The rulebook that is used for Paralympic and IPC World Championship competition can be accessed on the International Paralympic Committee’s Web site at:
http://www.paralympic.org
GLOSSARY OF TERMS

Active Stretching – when the person stretching applies the force for the stretch himself

Aerobic – in the presence of oxygen

Alignment - the degree to which the wheels are toed-in or toed-out and the degree to which they are parallel with main tube

Anaerobic – in the absence of oxygen

Attack – an aggressive tactical maneuver where one or more racers attempt to sprint away from the pack

Blocking – when one racer, or group of racers, attempt to slow their competitors’ progress by getting in their way

Boxed In – to be surrounded by other racers or physical barriers (curb, track, rail, etc.) and unable to pass on the left or right

Break or Breakaway – usually associated with pack racing when one or more racers attempt to force the pace and breakaway from the pack

Bridging – an attempt by one or more racers to catch competitors in front of them

Compensator – device connected to the front wheel via a cylinder and allows the front wheel angle to be varied from a straight line to a preferred turning arc

Cage – side rails that hold a racer’s torso in the wheelchair racing frame; must be carefully measured to the racer’s dimensions

Camber – the vertical angle of the rear wheels

Chasers – a pack of racers who have been dropped by the lead racer or racers; chasers attempt to work together as a pack to bridge the gap between themselves and the leader

Class – the divisions that categorize athletes according to their level of physical disability or age

Clinchers – bicycle tire that has a separate tire and tube

Compressor – electric air compressor for tire inflation

Computer – training aid that will help racer keep track of current speed, time and distance

Coordination – ability to move body parts in precise and accurate harmony (while pursuing a specific objective)

Core or Pillar Strength – strength in the trunk muscles: the abdominal muscles, the back muscles and the iliopsoas (hip flexor)

Cylinder – a shock absorbing device that maintains rigidity of the front wheel at all speeds; its spring-loaded action allows for smooth and controlled turning

Drafting – windbreak created from being behind another racer

Echelon – a paceline in which racers angle off behind the lead racer
**Endurance** – capacity to perform an activity for an extended time period

**Endurance Training**: training performed to increase the amount of time an athlete can perform at a given intensity; can take the form of aerobic endurance or anaerobic endurance

**Fartlek** – Swedish for speed-play; it’s characterized by repeat sprint intervals of no specific time or distance

**Fenders** – side guards that protect the wheelchair racer’s torso and arms from road debris and the rear wheels

**Flexibility** – the range of motion about a joint

**Fork** – the supporting member of the front wheel

**Full Recovery** – a rest period in which the athlete is allowed a full recovery from the preceding work

**Gap** – the distance between racers or a group of racers

**Ground Reaction Force** – the equal and opposite force exerted by the earth in response to a force exerted against the earth

**Handle Bars** – steering device

**Hand Rings** – the aluminum rings attached to the wheels of a racing wheelchair that are used for propulsion

**Head Set** – the pivot point for the front fork; it contains bushing and bearings, which ensure smooth operation

**Headwind** – running or pushing into the wind

**Hub** – the axle housing and center of the wheel; most racing hubs have sealed bearings

**Hydration** – adequate fluid intake to preserve skin integrity, maintain acid base balance of urine and guarantee normal bowel function without constipation

**Hypertension** – high blood pressure

**Hyperthermia** – overheating

**Hypotension** – low blood pressure

**Hypothermia** – cold intolerance

**Intervals** – a structured method of training that alternates relatively hard, short efforts with periods of easier pushing; interval training can be structured with specific ratios of work to rest

**Lactic Acid** – a fatiguing metabolite of the lactic acid system; a high level within the working muscles results in fatigue and acute pain

**Ligaments** – tissue that connects bones to bones

**Macro cycle** – a phase of training lasting three to six weeks

**Micro cycle** – a phase of training lasting one week

**Muscle Stretch Receptors** – reflex-inducing receptors located within the muscles that respond to stretching
**Out and back** – a race or training course with a common start and finish

**Overload Principle** – progressively increasing the intensity of the workouts over the course of the training program as fitness capacity improves

**Overtraining** – severe fatigue that does not subside following routine rest; overtraining is usually caused by a too rapid increase in training intensity and volume; signs and symptoms of overtraining include insomnia, depression, irritability, chronic muscle soreness and headaches; severe overtraining can only be cured by complete rest

**Passive Stretching** – when a partner or device provides the force for the stretch

**Peak** – a relatively short period of time during which maximum performance can be achieved; all training is structured to build toward a peak

**Periodization** – a strategy of organizing training into phases

**Point to Point** – a race or training course where there is a separate start and finish

**Power** – performance of work expressed per unit of time

**Power training**: power is the product of strength and speed and is developed through a variety of drills in which athletes attempt to move their body or implements as quickly and forcefully as possible

**Prime Movers** – the primary muscles that are used during the execution of a specific movement

**Range of Motion** – ability to go through the full range of possible movement about a joint

**R/r** - rest and recovery; can be active or complete; active R/r could include an easy jog following a hard interval

**Repetition** – a work period in interval and strength training

**Road Rash** – skin abrasions usually associated with a crash on the road or track

**Rollers** – a treadmill device used by wheelchair racers

**Rolling start** – a start with a run-up or roll-up

**Sets** – a specific number of repetitions performed in interval or strength training

**Sew Ups** – a very light racing tire where the outer tire tread and inner tube are one unit; sew ups are glued and centered onto wheel rims

**Speed** – ability to move body or body parts through given range of motion in the least amount of time

**Speed Training** – training performed to increase athletes’ maximum speed and agility

**Stabilizers** – muscles that anchor a limb’s position

**Standing start** – a start from a complete stop

**Step-Type Overload Principle** – a training load increase followed by an unloading phase during which the body adapts, regenerates and prepares for a new increase

**Strength** – ability to apply force, irrespective of the time needed to produce force
**Tailwind** – running or pushing with the wind blowing from behind

**Taking a Pull** – when the racer takes a turn pulling at the front of the pack

**Tendons** – tissue that connects muscles to bones

**Toe in/Toe out** – the angle of the wheels with respect to each other; it is a measure of how far from parallel two wheels are from each other

**Top-end** – a runner or wheelchair racer’s highest attainable speed
# ATHLETE PERFORMANCE RECORD

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<td>M/T/W/TR/F/S/SU</td>
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<td>Training / Competition Site:</td>
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<th>Today’s Goals:</th>
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<th>Training/Event Description</th>
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<th>Tomorrow’s Goals:</th>
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## Key to Record:
- Training week should be recorded in “Week of _/ _”
- Training day should be circled in “M/T/W/TR/F/S/SU” and the training or competition site – e.g., gym, track, road, Junior Nationals – should be recorded in “Training/Competition Site”
- The day’s event or practice goals should be identified in “Today’s Goals”
- “Training/Event Description” should identify the sets and repetitions if performing a strength training session, and events or drills if practicing or competing
- The recovery between reps and sets should be recorded under “r/r”
- The distances thrown, the times achieved, and the weight lifted should be recorded under “Results/Times/Lbs.”
- Strengths for the event or practice should be identified by athletes under “Strengths”
- Weaknesses for the event or practice should be identified by athletes under “Weaknesses”
- Any additional comments about how athletes felt about the event or practice should be identified under “Other Comments”
- Goals for the next day’s practice should be identified by athletes under “Tomorrow’s Goals”
SPORT SKILLS ASSESSMENT RECORD

Vern Gambetta (1997) suggests the following fundamental skills that athletes must develop to become adept in their event. The skills are traced through the basic, intermediate, and advanced stages.

Movement Skills

Basic: Introduce fundamental of movement skills such as walking, running, leaping, hopping, jumping, and pushing

Intermediate: Master fundamental movement skills

Advanced: Incorporate fundamental movement skills into training skills and drills

Technical Skill Level

Basic: Basic skills

Intermediate: Advanced skills

Advanced: Sport-specific advanced skills

Event Knowledge

Basic: Rules

Intermediate: Individual and team tactics

Advanced: Individual strategy and event analysis

Sportsmanship

Basic: Respect for teammates and coaches

Intermediate: Respect for officials

Advanced: Respect for fans

Interaction

Basic: Appropriate interaction with coaches and teammates

Intermediate: Cooperation with team and coaches in pursuit of personal goals

Advanced: Leadership

Emotional Development

Basic: Emotional control

Intermediate: Controlling competitive anxiety

Advanced: Positive competitive attitude
OTHER RESOURCE MATERIALS

Manufacturers to contact when ordering equipment and supplies.

Manufacturers of racing wheelchairs:

Eagle Sports Chairs
2351 Parkwood Road Snellville, GA 30278
1-800-932-9380 http://www.eaglesportschairs.com/homepage.html

Invacare
Top End 4501 63 Circle North Pinellas Park, FL 33781
1-800-532-8677 www.invacare.com

New Hall's Wheels
P.O. Box 380784 Cambridge, MA 02238
617-628-7955

Sunrise Medical
7477 East Dry Creek Parkway Longmont, CO 80503
1-800-333-4000 http://www.sunrisemedicalonline.com

Manufacturers of throwing wheelchairs:

Eagle Sports Chairs 2351 Parkwood Road Snellville, GA 30278
1-800-932-9380 http://www.eaglesportschairs.com/homepage.html

Manufacturers of racing wheelchair gloves:

Harness Designs (wheelchair racing gloves)
1511 West University Avenue Champaign, IL 61874
1-800-398-5794 http://www.harnessdesigns.com

Suppliers of field implements:

M&F Athletic Company
Everything Track & Field
1-800-556-7664 www.mfathletic.com

On Track
P.O. Box 1674 Burbank, CA 91507
1-800-697-2999 www.ontrackandfield.com/main/

Total equipment suppliers (racing wheelchairs, everyday wheelchairs, parts, gloves, wheels, and more):

Sportaid
78 Bay Creek Road Loganville, GA 30052
1-800-743-7203 www.sportaid.com

SpinLife
1108 City Park Ave., Ste. 201 Columbus, OH 43206
1-800-850-0335 www.spinlife.com/
Manufacturers of prosthetic and related equipment:

Otto Bock
Two Carlson Parkway, Suite 100 Minneapolis, MN 55447-4467
1-800-328-4058 www.ottobockus.com

Hanger Prosthetics & Orthotics, Inc 4301 North Classen Blvd. Oklahoma City, OK 73118
1-877-442-6437 www.hanger.com

Ossur 27412 Laguna Hills Aliso Viejo, CA 92656
1-800-233-6263 www.ossur.com

The Ohio Willow Wood Company
15441 Scioto-Darby Road P.O. Box 130 Mt. Sterling, Ohio 43143
1-877-699-2574 www.owwco.com

Publications of Interest

Sports ’n Spokes
2111 East Highland Avenue Suite 180 Phoenix, AZ 85016-4702
1-602-224-0500 www.sportsnspokes.com

Active Living
2276 Roseden Road St. Ann’s ON, LOR 1Y0
905-957-6016 www.activelivingmagazine.com

Palaestra
P.O. Box 508 Macomb, IL 61455
309-833-1902 www.palaestra.com

Web sites of Interest

International Paralympic Organization (IPC) (www.paralympic.org/)
The IPC is the international representative organization of elite sport for athletes with disabilities. Visit this site to learn more about the IPC, keep abreast of IPC news, find IPC sports’ descriptions, rules, records, classifications, and calendar.

US Paralympics (www.usparalympics.org)
USParalympics is the official body responsible for the development of US athletes with disabilities in Paralympic sport. Visit this site for descriptions of Paralympic sports, news and results on Paralympic athletes, a calendar of events, and more. A tremendous resource with links to a host of disability-related Websites can be found at: www.paralympic.org/service/links.htm
References


Unpublished Paper


Thanks to Carol Mushett Johnson and Ben Johnson for editorial input and document preparation. Thanks to Shea Cowert, Tony Fruci, and Paul Jarboe for offering their knowledge of prosthetic materials and amputee biomechanics. Thanks as well to Larry Hughes for offering his expertise on field apparel, throwing mechanics and throwing equipment. Finally, thanks to Tim Willis for supplying his insight to blind running mechanics and equipment.