Fundamental Mechanics of Alpine Skiing Across Adaptive Disciplines

Produced by PSIA-AASI, in cooperation with Disabled Sports USA.
The hips and upper body remain centered over the boot. Ankle flexion/extension moves pressure along the base of the ski.

Flex and extend joints evenly to keep body weight centered and balanced over the balls of the feet.

The arms are slightly raised, the elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level.

Outriggers have equal, constant and light pressure.

The hips and upper body remain centered between the skis and over the balls of the feet. The lowest usable joints will flex and extend to move pressure along the base of the ski.

Flex and extend joints evenly to keep weight centered in between the skis and over the balls of the feet. The CoM may move slightly to the inside as pitch increases.

The arms are slightly raised, elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level. Outriggers have equal, constant and light pressure.

Control the relationship of the center of mass (COM) to the base of support (BOS) to direct pressure along the length of the skis.

The skier is in balance when he or she can access and effect any of the skills throughout the turns.

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<th>Mono-ski</th>
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Skiers move their COM fore and aft using ankle flexion and extension.

Flex and extend joints evenly to keep body weight centered and balanced over the balls of the feet.

The arms are slightly raised, the elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level.

Outriggers have equal, constant and light pressure.

The hips and upper body remain centered between the skis and over the balls of the feet. The lowest usable joints will flex and extend to move pressure along the base of the ski.

Flex and extend joints evenly to keep weight centered in between the skis and over the balls of the feet. The CoM may move slightly to the inside as pitch increases.

The arms are slightly raised, elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level. Outriggers have equal, constant and light pressure.

Flexion and extension of the hips (if available) and spine center weight over the middle of the ski and allow the skier to move the COM fore and aft.

The hips and upper body remain centered over the midline of the ski.

The arms are slightly raised, elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level. Outriggers have equal, constant and light pressure.

The skier is in balance when he or she can access and effect any of the skills throughout the turns.
Control the relationship of the center of mass (COM) to the base of support (BOS) to direct pressure along the length of the skis.

The upper body remains more vertical than the lower body throughout the shaping and finishing phases of the turn, creating body angles which align balance over the outside ski.

Inside hand, shoulder, and hip lead through a turn as is appropriate for the pitch of the terrain and the turn shape and size.

Shoulders, hips and hands are all parallel to the pitch of the hill.

Nearing the completion of the previous turn, the skier’s upper body and hips are slightly flexed and countered in the direction of the new turn leading to pressure dominance on the old outside ski.

Inside hand, shoulder, and hip lead through a turn as is appropriate for the pitch of the terrain and the turn shape and size.

Shoulders, hips and hands are all parallel to the pitch of the hill.

Flexion down and inward helps regulate pressure and allows the skier to distribute weight along the length of the ski.

Inside hand, shoulder, and hip lead through a turn as is appropriate for the pitch of the terrain and the turn shape and size.

Shoulders, hips and hands are all parallel to the pitch of the hill.

Flexion down and inward regulates pressure.

Inside hand, shoulder, and hip lead through a turn as is appropriate for the pitch of the terrain and the turn shape and size. The turning outrigger is brought back toward the skier’s midline early in the shaping phase of the turn.

Shoulders, hips and hands are all parallel to the pitch of the hill.

The movements a skier makes to manage pressure on the ski(s) also affect the momentary relationship between the COM and the BOS.
Rotational Control - Beginner/Novice Zone

**Turn the legs underneath, and in opposition to, the upper body.**

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<td>The skier's legs turn underneath a strong stable torso to help guide the skis through the turn.</td>
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<td>Leg steering is generated as low in the body as possible to guide the skis through the turn.</td>
<td>Leg steering is generated as low in the body as possible to guide the skis. Some four track skiers will turn the upper body above the lower body.</td>
<td>The upper body will often turn above the lower body.</td>
</tr>
<tr>
<td>The skis are turned progressively to create a smooth, c-shaped arc.</td>
<td>At turn initiation, both outrigger tips are pointed in the direction of the next turn. This movement is held throughout the shaping phase of the turn.</td>
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<td>The upper body remains quiet and stable.</td>
<td>Symmetrical outrigger steering may be used as a supplement to the primary rotary power of leg steering.</td>
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<td>Symmetrical outrigger steering will supplement the primary rotary power of the legs, hips, or torso.</td>
<td>The tips of both outriggers remain in close proximity to the knees.</td>
</tr>
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</table>

Rotary (steering) movements redirect the ski(s) at turn initiation with the femur(s) turning in the hip sockets and continue turning throughout the turn.
Legs turn underneath, and in opposition to, the upper body.

The femur turns within the hip socket, instead of the entire hip coming around.

Rotary movements redirect the ski(s) at turn initiation.

Prior to or after the fall line, the new inside ski is guided to a matching relationship with the outside ski.

The ski and lower body is allowed to turn slightly more than the upper body, resulting in a slightly countered relationship with the ski (i.e., head, shoulders, torso, and hips slightly countered in the direction of the next turn).

Emphasis is on leg steering at turn initiation steering with the legs throughout the shaping phase of the turn.

Asymmetrical outrigger steering may be used as a rotary enhancer at turn initiation one outrigger tip is pointed in the direction of the next turn.

The new inside outrigger is “matched” or moved (toward the midline) back to the neutral position prior to or after the fall line of the turn (similar to the “match” of the skis of a standup skier doing a wedge Christie).

The ski and lower body are allowed to turn slightly more than the upper body, resulting in a slightly countered relationship with the ski (i.e., head, shoulders, torso, and hips slightly countered in the direction of the next turn).

Emphasis is on leg steering at turn initiation steering with the legs throughout the shaping phase of the turn.

Asymmetrical outrigger steering may be used as a rotary enhancer at turn initiation, one outrigger tip is pointed in the direction of the next turn.

At turn initiation, a wedge is created through leg steering. Skis are subsequently matched into a parallel relationship before or after the fall line. Asymmetrical outrigger steering may be used as a rotary enhancer. At turn initiation, one outrigger tip is pointed in the direction of the next turn.

Terrain dictated edging and pressure on the inside edge of the ski results in the outriggers becoming light and flat. Outriggers are symmetrically guided into a parallel relationship with the skis.

As much as is physically possible, emphasis is on leg steering at turn initiation.

Asymmetrical outrigger steering will enhance the ability of the legs or trunk to guide the skis through the turn. At turn initiation one outrigger tip is pointed in the direction of the next turn.

The new inside outrigger is “matched” or moved (toward the midline) back to the neutral position prior to or after the fall line of the turn (similar to the “match” of the skis of a standup skier doing a wedge Christie).

The ski and lower body are allowed to turn slightly more than the upper body, resulting in a slightly countered relationship with the ski (i.e., head and shoulders slightly countered in the direction of the next turn).

Monoskiers enhance their rotary movements by creating torque through differential friction via outrigger steering.

At turn initiation the new inside outrigger tip is pointed in the direction of the next turn. The downhill outrigger will be farther away from the mono ski than in the wedge turn because of the increased counter of the upper body.

The new inside outrigger is “matched” or moved (toward the midline) back to the neutral position prior to or after the fall line of the turn (similar to the “match” of the skis of a standup skier doing a classic wedge Christie).
Edge Control - Beginner/Novice Zone

Edge control is the ability to tip the skis on edge and adjust their angle. Skiers control edge angles through inclination and angulation.

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Edge control allows the skier to direct the skis to control turn radius, shape, and speed.

Beginner/novice zone skiing shows the basic skills of skiing in a slow moving situation, emphasizing strong leg steering with limited edge movements to maintain turn speed and radius.

The center of mass may move slightly to the inside of the turn on steeper terrain (terrain dictated edging). A slight amount of banking is acceptable in order to control the edge angle.

The hips and upper body remain centered over the ski and the skier maintains the tips of both outriggers in close proximity to the tip of the ski. There are no countering movements of the outrigger and no reaching downhill.

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The hips and upper body remain centered between the skis and the skier maintains the tips of both outriggers in close proximity to the tip of the ski. There are no countering movements of the outrigger and no reaching downhill.

Beginner/novice zone skiing shows the basic skills of skiing in a slow moving situation, emphasizing leg, hip, and/or torso steering (supplemented as needed by outrigger steering) with limited edge and pressure movements to maintain constant speed and radius of the turn.

The center of mass may move slightly to the inside of the turn on steeper terrain (terrain dictated edging). A slight amount of banking is acceptable in order to control the edge angle.

The hips and upper body remain centered between the skis and the skier maintains the tips of both outriggers in close proximity to the tip of the ski. There are no countering movements of the outrigger and no reaching downhill.

Beginner/novice zone skiing shows the basic skills of skiing in a slow moving situation, emphasizing the rotary movements created by the outriggers with limited edge and pressure movements to maintain constant speed and radius of the turn.

The center of mass may move slightly to the inside of the turn on steeper terrain (terrain dictated edging). A slight amount of banking is acceptable in order to control the edge angle.

The hips and upper body remain centered over the ski and the skier maintains the tips of both outriggers in close proximity to the tip of the ski. There are no countering movements of the outrigger and no reaching downhill.

Effective edge control at low speeds and on flat terrain involves using only the amount of edge angle necessary to allow a gliding action of the skis.
Edge control is the ability to tip the skis on edge and adjust their angle. Skiers control edge angles through inclination and angulation.

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<td>Asymmetrical outrigger steering movement and the skier's extension toward the new turn result in cross over or lateral movement of the center of mass and a change in ski edges.</td>
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<td>Tension of the inside leg helps maintain alignment. Flexion of the inside ankle directs movement forward and laterally for edge-angle adjustments.</td>
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<td>Some stand-up outrigger users maintain alignment by creating tension using their lowest functional body part (core, torso, and/or shoulders). Extension of the spine directs movement forward and laterally for edge-angle adjustments. The inside outrigger and rigger ski complement the actions of the dominant inside edge of ski.</td>
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<td>The shins make forward and lateral contact with the boot cuffs as the skier rolls the skis onto the new edges.</td>
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<td>Hips, knees, and ankles work together to help the skier make forward and lateral contact with the boot cuffs and to roll the skis onto the new edges.</td>
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<td>A progressive increase of edging in the turn reduces the amount of skid and helps shape the arc of the turn.</td>
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<td>Forward and lateral contact with the seat and/or chest retention strap allows the skier to roll the ski onto the new edges.</td>
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### Directional Movement - Beginner/Novice Zone

Regulate the magnitude of pressure created through ski/snow interaction.

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#### Two Tracking

- At beginner/novice zone speeds, the skier requires limited pressure management to maintain speed and turn shape.
- Subtle flexing activity originates from the ankles and is supported by the knees, hips, and lower back. The amount of flexion and extension of the skier's legs changes in response to the terrain and pitch of the slope.

#### Three Tracking

- At beginner/novice zone speeds, the skier requires limited pressure management to maintain speed and turn shape.
- Subtle flexing activity originates from the ankles and is supported by the knees, hips, and lower back. The amount of flexion and extension of the skier's legs changes in response to the terrain and pitch of the slope.

#### Four Tracking (Wedge Ability)

- At beginner/novice zone speeds, the skier requires limited pressure management to maintain speed and turn shape.
- Subtle flexing activity originates from the ankles and is supported by the knees, hips, and lower back. The amount of flexion and extension of the skier's legs changes in response to the terrain and pitch of the slope.

#### Four Tracking (Unable to hold a wedge)

- At beginner/novice zone speeds, the skier requires limited pressure management to maintain speed and turn shape.
- All functioning body joints are relaxed allowing feet, legs, and torso (if necessary) to be available for turning the skis. The arms and outriggers also flex and extend as needed to complement movements of the legs. The amount of flexion and extension of the skier's hips and spine changes in response to the terrain and pitch of the slope.

#### Mono-ski

- At beginner/novice zone speeds, the skier requires limited pressure management to maintain speed and turn shape.
- The hips and lower back flex and extend to regulate pressure through the ski. Flexing and extending the arms allows the skier to vary the amount of pressure through the outriggers to the snow. The amount of flexion and extension of the skier's hips and spine changes in response to the terrain and pitch of the slope.
Resisting or absorbing forces with flexion and extension helps manage the increased pressures created by turning. At the completion of the turn, a slightly flexed stance, countered in the direction of the new turn, distributes pressure between both skis and allows the skier to manage the forces built through the turn. The pole swings smoothly in the direction of travel.

### Two Tracking
Resisting or absorbing forces with flexion and extension helps manage the increased pressures created by turning. At the completion of the turn, a slightly flexed stance, countered in the direction of the new turn, distributes pressure along the inside edge of the ski and allows the skier to manage the forces built through the turn.

### Three Tracking
Resisting or absorbing forces with flexion and extension of all usable joints helps manage the increased pressures created by turning. At the completion of the turn, a slightly flexed stance, countered in the direction of the new turn distributes pressure between both skis and allows the skier to manage the forces built through the turn.

### Four Tracking (Any Ability)
Resisting or absorbing forces with flexion and extension, especially with counter of the hips, spine and arms, helps manage the increased pressures created by turning. At the completion of the turn, a slightly flexed stance, countered in the direction of the new turn distributes pressure between both skis and allows the skier to manage the forces built through the turn.

### Mono-ski
Resisting or absorbing forces with flexion and extension, especially with counter of the hips, spine and arms, helps manage the increased pressures created by turning. Movement of the new inside outrigger toward the new turn complements the countered upper body at turn initiation and helps facilitate effective directional movement.

The importance of a functional stance and accurate movements cannot be overstated; any movement that negatively impacts these elements will have a negative impact on the skier’s ability to move effectively.
### Bi-Ski Skiing | Pressure Control - Beginner/Novice Zone

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<th>Bi-ski Edge Prioritized</th>
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<tr>
<td>Hips and upper body remain centered between the skis. The COM may move slightly to the inside of the turn as speed and terrain pitch increase.</td>
<td>Hips and upper body remain centered over the midline of the skis. Subtle shifts in balance and pressure from skis edge to skis edge introduce inclination and moving the COM to the inside of the turn.</td>
<td>Tall stance and balanced upper body over the midline of the skis with head and eyes up. Utilize push off, drop ‘n block.</td>
</tr>
<tr>
<td>Focus on decreasing edge angles and flattening the skis to start the new turn introduces movements of edge release.</td>
<td>Focus on decreasing edge angles and flattening the skis to start the new turn introduces movements of edge release.</td>
<td>Subtle movements of the upper body and shoulders across the skis laterally introduces ski to ski pressure changes.</td>
</tr>
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<td>Pressure movements are minimal, with a static upper body and minimal to no fore and aft pressure movements.</td>
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<td>At turn initiation pressure on the uphill outrigger is increased as the skier pushes off to create an active crossover movement.</td>
</tr>
<tr>
<td>The upper body remains quiet and disciplined.</td>
<td>Sit-skiers depend on their outriggers to develop rotary through friction. While the upper body should remain as disciplined as possible, it is more involved with turning than in other disciplines.</td>
<td>Keeping the head facing the direction of travel introduces the sensation of countering, essential to a bi-skier’s success.</td>
</tr>
<tr>
<td>Vision stays forward, looking ahead in the intended direction of travel.</td>
<td>Keeping the head facing the direction of travel introduces the sensation of countering, essential to a bi-skier’s success.</td>
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### Bi-Ski Skiing | Balance & Stance - Beginner/Novice Zone

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<td>Skiers move their COM fore and aft using ankle flexion and extension.</td>
<td>Flexion and extension of the hips (if available) and spine center weight over the middle of the skis and allow the skier to move the COM fore and aft.</td>
<td>Flexion and extension of the hips (if available) and torso help center the weight over the middle of the skis and allow the skier to move the CoM fore and aft.</td>
</tr>
<tr>
<td>Flex and extend joints evenly to keep body weight centered and balanced over the balls of the feet.</td>
<td>The hips and upper body remain basically centered over the midline of the skis.</td>
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<td>The arms are slightly raised, the elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level.</td>
<td>The arms are slightly raised, elbows are in front of the body, and the hands are slightly wider than the elbows. The shoulders, hands, and hips are level.</td>
<td>The arms and elbows are in line with the torso and hips. Outrigger pressure is constant and deliberate.</td>
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</tbody>
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**Bi-Ski Skiing | Pressure Control - Intermediate/Advanced Zone**

**Two Tracking**

The skier extends in the direction of the new turn to change edges.

The ankles, knees, and hips roll forward and laterally to move into the new turn.

As the skier starts extending toward the new turn, a change in pressure dominance begins from the old outside ski to the new outside ski.

The inside leg shortens as the outside leg lengthens, setting up alignment and balance with weight on the outside ski.

Flexion down and inward regulates pressure and is progressive through the end of the turn.

**Bi-ski (Any Ability)**

As the skier improves, (s)he increases the extension of the torso, arm and outrigger to contact the snow farther away from the midline of the ski. The torso, arm, and outrigger are all involved in pointing the outrigger toward the center of the new turn.

The chest and spine roll forward and laterally to move into the new turn.

As the skier starts extending toward the new turn, a change in pressure dominance begins from the old inside edges to the new inside edges.

The inside outrigger arm is bent more than the outside outrigger arm.

Nearing the completion of the previous turn, the skier’s upper body is slightly flexed and countered in the direction of the new turn leading to pressure dominance on the old inside edges.

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**Bi-Ski Skiing | Balance & Stance - Intermediate/Advanced Zone**

**Two Tracking**

The upper body remains more vertical than the lower body throughout the shaping and finishing phases of the turn, creating body angles which align balance over the outside ski.

Inside hand, shoulder, and hip lead through a turn as is appropriate for the pitch of the terrain and the turn shape and size.

Shoulders, hips and hands are all parallel to the pitch of the hill.

**Bi-ski (Any Ability)**

Flexion down and inward regulates pressure and is progressive throughout the turn.

Inside hand, shoulder, and hip lead through a turn as is appropriate for the pitch of the terrain and the turn shape and size. The turning outrigger is brought back toward the inside ski early in the shaping phase of the turn.

Shoulders, hips and hands are all parallel to the pitch of the hill.