



Abstract

This manual was developed to benefit both new sitski tetherer's and tethering instructors and is an amalgamation of many experienced sitski instructors knowledge. Its primary goal is a reference guide to promote safe and successful tethering technique.

Sitski Tetherer Training Reference Manual

November 2018

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1 Introduction

1.1 Canadian Adaptive Snowsports Mission

The Canadian Adaptive Snowsports (CADS) organization provides opportunities for people with disabilities to experience the joy of participating and competing in alpine snowsports. CADS achieves this by developing and promoting adaptive snowsports through partnerships, training, and instructor certification programs.

1.2 Canadian Adaptive Snowsports Vision

To be recognized nationally and internationally for its leadership in alpine adaptive snowsports.

1.3 Alpine Responsibility Code

There are elements of risk that common sense and personal awareness can help reduce. Regardless of how you decide to use the slopes, always show courtesy to others. Please adhere to the code listed below and share with others the responsibility for a safe outdoor experience.

Tetherers, sitskiers and CADS Members are responsible for the same ski rules as all other ski resort patrons.

- ✓ Always stay in control. You must be able to stop, or avoid other people or objects.
- ✓ People ahead of you have the right-of-way. It is your responsibility to avoid them.
- ✓ Do not stop where you obstruct a trail, or are not visible from above.
- ✓ Before starting downhill or merging onto a trail, look uphill and yield to others.
- ✓ If you are involved in or witness a collision/accident you must remain at the scene and identify yourself to the Ski Patrol.
- ✓ Always use proper devices to help prevent runaway equipment.
- ✓ Observe and obey all posted signs and warnings.
- ✓ Keep off closed trails and obey area closures.
- ✓ You must not use lifts or terrain if your ability is impaired through the use of alcohol or drugs.
- ✓ You must have sufficient physical dexterity, ability, and knowledge to safely load, ride, and unload lifts. If in doubt, ask the lift attendant.

Know the Code – Be Safety Conscious! It is your responsibility.

1.4 Legal Disclaimer

Skiing is an inherently complex and dangerous sport. Sitskiing and tethering a sitski have some additional challenges. No liability is accepted for the consequences of following the advice in this document. The reader must decide if the advice is appropriate for their sitskier, their skill levels, equipment and environment.

Before attempting to tether a sitski, some discussion must take place between the tetherer and the Program Coordinator to make sure that the new tetherer has the appropriate skiing skills and doesn't have any physical limitations that would inhibit safe tethering for the athlete, themselves and other patrons of the ski hill. It should be noted that loading a sitski could put

strain on shoulders and lower back, especially if the athlete is unable to self-load or assist in the loading. While skiing, tethering can put strain on shoulders, back, knees and hips. If a pre-existing injury exists, it can be re-injured or new injuries can be sustained.

1.5 References

The following references have been used within this guide:

Reference	Availability
CADS Instructor Manual	CADS Instructor Manual 2016
CASI Reference Guide (Level 1)	https://casi-acms.com/index.php/en/resources-course
National Coaching Certification Program guidelines	www.coach.ca

1.6 Revision History

The goal is to update and revise this guide on an annual basis. Your assistance is greatly appreciated. If you find spelling or grammar errors, inconsistencies or inaccuracies please take the time to email (tether_updates@h-hitech.com). Indicate the version of the document you referencing (lower left of each page), page/section numbers and a description of the problem. Each year the authors will review input and update the manual accordingly. Thanks in advance.

Date	Description
2018, November	Version 1 published
	Next version planned for January 2019 after a December 2018 pilot phase.

2 Approach Used for this Course

This resource manual is the key information guide for the new “Sitski Tethering” courses. These courses are designed to give participants plenty of opportunities to do and think for themselves. Competency-based education and training is founded on the concept of learning by doing. Coaches learn good coaching habits when they have the opportunity to practice effective coaching behaviours.

2.1 Prerequisites

Section 9.4 of the CADS Instructor Manual Sitski (Monoski, Biski and Quadski) must be read and understood by anyone attempting to tether a sitski. It contains a plethora of information on assessing a sitskier, equipment fitting and teaching progression. To date, information on how to tether a sitski has been missing, this document will fill that void.

It is strongly recommended for Program Coordinators and/or Course Conductor to conduct a skiing/boarding test to commence the tetherer training to ensure the candidate is at a sufficient competency to succeed at tethering.

2.2 Terminology

For this training document:

- ✓ the person in the sitski will be referred to as the **sitskier**
- ✓ the person attached to the sitski via the tethers will be referred to, as the **tetherer**
- ✓ the person teaching the tetherer will be the **instructor**
- ✓ The **program coordinator** is the person in charge of the overall program where the instruction and skiing takes place
- ✓ A **quadski** is a biski with fixed outriggers attached
- ✓ A **biski** is a sitski that uses 2 skis (with or without handheld outriggers)
- ✓ A **monoski** is a sitski with only 1 ski attached

2.3 Course Outline and Durations

This course will be delivered over 2 days and contains 12.5 hours of instruction. The majority of the course will be conducted on-hill, requiring participants to dress appropriately for the weather conditions. Refer to Appendix A for details.

3 Tethering 101

When done correctly, tethering a sitski can be very safe and thoroughly enjoyable.

Watching a good tetherer and sitski team is like watching a ballet pair or maybe Ginger Rogers and Fred Astaire. Done properly, tethering is a technique skill and is not a strength and stamina skill. In its simplest form, tethering is about getting the sitski on edge the correct amount. If the skis are on edge, the sitski turns and the sitskier and tetherer can control their descent.

***Putting the ski on edge the right amount for the terrain
and speed – that's it – nothing magical!***

For most programs there is a wide variety of tethering capabilities that are required; ranging from those that can work with a very cooperative lightweight sitskier with hand held outriggers to those that can tether a less cooperative, heavy sitskier in a quadski and every combination in between. Obviously for the person responsible for doing the matchups of tetherer and sitskier, the more advanced a tetherer, the easier it is during the match up process. Not everyone will be able to tether every sitskier and it is important to express when you feel uncomfortable with an assignment. Everyone has a limit to their abilities and exceeding those abilities should be avoided for the safety of the sitskier, the tetherer and other patrons on the hill.

The tetherer should always feel they are capable of assisting the sitskier in a safe and fun experience. There is no shame or discredit for a tetherer to tell the Program Coordinator that they are uncomfortable with a particular match up!

3.1 The Role of a Tetherer

The role of a tetherer isn't to simply slow, stop or turn the sitskier. As a tetherer, you are in a unique position, and often looked upon as a peer, friend, or guide. Quality of Tethering can be the deciding factor in whether a beginner sitskier chooses to continue with the program, and as such you have an impact on their future. A sign of a good tetherer is when the athlete cannot tell if they are being tethered.

The following skills and attitudes will help you make you more effective as a tetherer:

- ✓ A positive attitude. Tetherers must express a positive attitude towards skiing. A sitskier trying to acquire new skills or apply learned techniques will respond to a positive, patient, supportive partnership. This will also make your tethering tasks easier, as the sitskier will be assisting in the turns, stops, etc.,
- ✓ Be a confident, strong intermediate or better skier or telemark skier – parallel skier, with the capability of also snowplowing and controlled side slipping,
- ✓ Be a strong advanced snowboarder Confident use of inclination and angulation to perform carved turns both regular and switch.,
- ✓ Be reasonably fit and not have significant knee, shoulder, hip or back issues, and
- ✓ Ability to ski/board while maintaining situational awareness without affecting their own form.

3.2 Ski and Board Considerations

Equipment can make a big difference in the tetherer's ability to effectively and safely perform their tasks. This section outlines the best practices and considerations for tetherers.

Optimal width of the skis and boards depends on the average snowfall and snow conditions of your local hill. Narrow waist skis do make tethering a bit more comfortable on groomed runs and hard-pack snow. Softer and deeper snow conditions will benefit from wider waist skis and boards.

3.2.1 Skis

Skis can make a difference in a person's ability to tether effectively but for most skiers their everyday skis will be perfectly acceptable. Shorter skis are generally preferred but when skis are too short, hard braking will require significantly more effort and balance. Quick turning skis with a shorter radius (e.g. 13 or 14 metres) make it easier to control position and easier to make quick corrections. Very long skis, stiffer racing skis or longer radius skis can make tethering more difficult. Overly sharp edges are over rated. With less tuned skis, the tetherer will have an easier time side slipping, switching directions, and generally give the sitskier a smoother ride because movements will be less pronounced, and more gradual. Again, it's a finesse sport, not all on, all off.

3.2.2 Telemark

Only advanced or expert telemarkers should be considered to become tetherers, and should be able to do every skiing skill as required in the ski test.

If a tetherer chooses to use telemark equipment, they should be comfortable parallel skiing, able to make quick direction changes, and ski backwards on their skis. There are NO circumstances that require, or is advantageous for, a telemarking tetherer to do telemark style turns while tethering, and they should refrain from doing so while tethering as it unnecessarily makes tethering harder.

The new style of binding, New Telemark Norm (NTN) have many advantages over the traditional 75mm duck bill style system and are therefore better suited use in a CADS program:

- ✓ will release laterally
- ✓ have brakes similar to a traditional alpine binding when the ski attached to a boot
- ✓ are very easy to put on/off without having to bend over
- ✓ do not require leashes

If a tether chooses to use the older 75mm system, they should understand disadvantages of using them:

- × Inability to release in the event of a fall, which greatly increases the risk of injury
- × Higher chances of a runaway ski if the ski isn't on your foot with the leash attached
- × Reduces the ability to removing the skis mid-run to help with lifting after a fall, or with adjusting equipment

Any binding that telemarkers choose to use should have strong return springs and be very stiff laterally for better edge control. They must be paired with stiff, plastic, 3-4 buckles modern telemark boots. Leather boots aren't sufficient to deal with the requirements of tethering.

3.2.3 Snowboards

Freestyle, twin tip, or other symmetrical designs are more effective for snowboarding due to the need to confidently and smoothly change riding direction between regular and switch (pendulum manoeuvres). Ideally a centered "duck stance" set-up should be used, as it allows the most comfortable and stable body position when tethering; binding angles will depend on the preference of the rider, but consideration for body position should be noted.

There is no advantage for a snowboarder to naturally ride regular or goofy. As long as they are comfortable on both edges and can confidently ride switch on demand.

Carving boards should not be used: directional (e.g. carving) boards limit the abilities of the tetherer in the "off" direction. Additionally, these boards most often use race-style or hard boots that reduce the ability to flex the ankle joint and are not intended for constant transition between low and high edge angle.

3.3 Clothing & Personal Equipment Considerations

As a tetherer you are a skier/boarder out on the hill but you are also a partner for the sitskier. In many cases your sitskier will be under the age of majority or may be an adult with developmental disabilities. In these cases, you will be considered a temporary care provider and it's especially important to be prepared:

- ✓ **Clothing.** Tethering can be more strenuous than normal skiing or boarding, so it's good to dress in layers and consider things like vents, to balance staying warm with not sweating & overheating
- ✓ **Helmet.** Helmets are mandatory for participants and volunteers.
- ✓ **Goggles.** It is highly recommended that all sitskiers use goggles while skiing and especially when in, and around, lift lines or other congested areas (e.g. top of the ski lift). It should be noted that sitskiers are at a height where swinging ski poles are at head/eye level
- ✓ **Gloves** – Tethering is hard on gloves. Ordinary ski gloves have thin nylon shell and don't last long. Some tetherers invest in tough leather ski gloves, others use work gloves and consider them disposable. You are also likely to need to remove your gloves to adjust buckles or the sitskier's clothing. Many tetherers like to wear inner gloves that are thin enough to wear while working with your fingers
- ✓ **Shin pads** – If you are tethering a quad ski, with a manual load (e.g. a Mountain Man) you may find that the fixed outriggers can hit your shins when the sitski is pulled back onto the chair lift. Soccer or hockey shin pads under your ski pants can avoid bruised shins. Telemarking knee pads can be worn low so they are just above the boot to protect the shin, as well it nice to keep your knees warm when kneeling in the snow adjusting equipment for your sit skier
- ✓ **Phone** – This can be a great piece of safety equipment, (assuming you aren't issued with a two-way radio) so you can call ski patrol or you program director in an emergency. Be

sure to pre-program your program coordinator and local ski patrol's phone numbers into your phone. With the fact that phone batteries have shortened durations in colder temperatures and the possibility of falling or banging into a hard sitski, it is recommended that you carry your phone in an inside layers chest pocket. This will help keep the phone out of harm's way and will also keep it warmer.

- ✓ **Comfort supplies.** This can include tissues, hot pockets, a spare balaclava, sun screen, spare goggles or sunglasses. Remember it is much easier for you to reach your pockets and your skiers face than it is for them.
- ✓ **Tools.** As you become more experienced as a tetherer, you may find that a selection of tools can come in handy. For example, a small multi-tool that has a wrench/pliers and screw drivers included, tape (wad of duct tape or roll of electrical tape) and a few zip ties can come in very handy. These small items can allow you to finish a run and get your sitskier to comfort and safety after a strap or buckle breaks on the hill.

4 Tetherer Levels: Core Skills Competency

Below is a description of the competency levels of tetherer and some indicators to classify their abilities. It ranges from a brand new tetherer who is potentially incapable of tethering a live person in a sitski to a highly qualified tetherer capable of tethering all types of sitskis and all levels of sitskier abilities. It is up to the individual program coordinators to determine match ups of tetherers, instructors and sitskiers. Most Program Coordinators will err in the side of caution when doing the match ups for the safety of the sitskier and tetherer.

4.1 Beginner Tetherer	
<ul style="list-style-type: none"> ✓ Tethering a weighted quadski “Sandy” and is not certified to tether a real person ✓ Tethers quadski only ✓ Chairlift and Conveyor lifts only 	
Skills Demonstrated	Skill Development
Often follows directly behind the sitski.	Demonstrate leading the turns and being on the inside before the sitskier turns.
Turns the sitski primarily using exaggerated arm motions, including “driving bus” technique where inside hand is low, outside hand is higher; shoulders are protected.	Ability to use body position as the primary mechanism to turn the ski; appropriate arm movements to assist in controlled initiation and maintenance of turn. Continue to work on “driving the bus” motion to assist in edging the sitski where elbows are close to the body and inside hand is lower, outside hand is higher.
Position and or ski technique requires work. May use a carved turn and ‘over run’ the sitskier.	Demonstrate ability to side slip, snowplow and parallel turn as required while maintaining speed control and consistent tether pressure.
Tension on tethers is inconsistent.	Consistent tension on both tethers throughout the turns, and especially in the transitions.
Rolling/flipping of the sitski.	Ability to tether a sitski from top to bottom without rolling or flipping, using a variety of turn shapes and sizes and speeds ranging from slow to medium.

Speed management is inconsistent.	Ability to maintain a consistent speed appropriate for the pitch; be able to adjust the speed fluidly according to the terrain.
Emergency stopping is slow or a struggle.	Demonstrate the ability to execute a fast, smooth and safe emergency stop in an appropriate distance for the speed and terrain on various terrains and executed in the correct direction. Must be able to stop in both directions.
Lift-line management and loading of sitski on chair lift is inconsistent.	Ensure safety of sitskier, tetherer and patrons in lift-lines. Demonstrate as the lead, a smooth and consistent approaches to chair lift and safe, efficient loading of sitski on chair
Needs to focus on the ski more than on terrain – and on other sitskiers; relies on Instructor or partner to “run interference” for other patrons.	Demonstrate the ability maintain situational awareness. Keep head on swivel (180-degree awareness). Ability to anticipate patrons movements
Focuses on themselves and tethering and not on sitskier’s technique.	Communicate turns and expectations with sitskier (e.g. call turns before initiating with tethers, ask for balance on flats, etc.)
“Pontoon wobble” on flats and/or when coming to a stop Must “thumb” the sitski over flats to maintain control.	Ability to control sitski across flats without significant “pontoon wobble” most of the time. Demonstrate skiing the quadski on flat terrain, decrease use of pontoons on flats.

4.2 Intermediate Tetherer

- ✓ Tethers quadski only
- ✓ Can tether a person using a quadski i.e. fixed outriggers setup
- ✓ Chairlift, Conveyor lifts , and Gondolas/Trams

Skills Demonstrated	Skill Development
Starting to use terrain to advantage.	Continue to use terrain to slow the sitski, initiate turns, and maintain consistent speed control.
Emergency stopping is consistent but may still require more significant effort. Good body position; capable of stopping in both directions.	Reducing the need for emergency stops by pre-emptively planning and managing terrain and situations. Less effort required when emergency stops are required with improved ski and body position
Occasional bouncing between the fixed outriggers on flats and/or when coming to a stop.	Continue to work on ski position behind sitski and maintain good tension on the tethers to maintain edge control or flat skis depending on the terrain. Continue to work on speed control (allow for faster speeds approaching flats to allow for a balanced glide). Work on skiing bi skis without using pontoons on flatter terrain.
Position relatively good but still follows the sitskier occasionally.	Demonstrate leading the turns and being on the inside before the sitskier turns.
Coordinated use of body position and arm technique to create and maintain sitski edge.	Introduction of elbow and wrist joints to assist in the more finessed tether tension and angles. Work on being proactive with smaller adjustments early to effect a change in edge or maintenance of edge pressure.

<p>Relatively good 180-degree awareness but still must rely on blocker (i.e. more concentration on forward/side than 360-degree).</p>	<p>Continue to work on 360-degree awareness where tetherer is assessing patrons behind them as well as in front and on their sides. Continue to work on the ability to anticipate other patron's intent. When sitskier is starting to look, tetherer is moving to the inside of next turn</p>
<p>Tetherer is comfortable with slower to medium speed but less comfortable with faster speeds and varying terrain.</p>	<p>While CADS does not condone high-speed tethering runs, there are times to demonstrate faster speeds (e.g. end of a pitch just before a flat). Tetherer should continue to work with tether tension, ski position, edge control and 360 awareness to become more comfortable at faster speeds.</p>
<p>Tether control (short, long, medium) –Tetherer is more comfortable changing tether length based on situation and is not always running one length of tethers.</p>	<p>Continue to practice and demonstrate the ability to change tether lengths by wrapping and un-wrapping tethers from hands to maintain appropriate tether length and tension based on the speed, terrain, and sitskier skill. While still maintaining proper tension and position</p>
<p>Is progressing towards teamwork with sitskier – having sitskier assist but still focused more on their own tethering and or other aspects of skiing. Tetherer initiates most turns independently of the sitskier.</p>	<p>Demonstrate the ability to proactively call for sitskier to initiate next turn (weight transfer) to assist in the transition from one turn to the next. Ability to continue to talk and work with the sitskier to maintain turning radius.</p>
<p>May not be able to perform AOT on sitskier form & technique or on their own tethering form.</p>	<p>Continue to log miles to become more comfortable in different situations. As tethering experience increases, the ability to perform AOT skills for sitskier technique will improve.</p>

4.3 Advanced Tetherer

Is capable of tethering:

- ✓ Quadski, biski or monoski
- ✓ athlete with handheld outriggers
- ✓ Chairlift, Conveyor lifts, and Gondolas/Trams

Not qualified for tethering semi-independent sitskiers looking to move off the tethers (either biski or monoski) – including single tether

Skills Demonstrated	Skill Development
Excellent control, especially where tension on tethers required all the time. Uses elbow, wrists and fingers to tweak tension control.	Ability to release and re-tension tethers without affecting the sitskier's balance. Ability to react to their own balance challenges (e.g. skis on ice, bumps, and rolls) and not affect the sitskier.
Stopping – emergency and planned stops (gravity assisted or hockey stops) are consistent but are initiated by the tetherer. When assisting sitskiers with handheld outriggers, tetherer may affect sitskier's balance on stop.	Ability to provide stopping assistance for sitskiers with handheld outriggers without affecting sitskiers balance. Transition decisions and initiation of stopping actions to sitskier and instruct situational awareness to reduce need for emergency stops by using speed control and/or planned stops.
Medium to high speed capable and uses speed appropriately for terrain and situation.	Allow the sitskier to lead the effort in the speed control and terrain selection if the skier is capable.
360-degree awareness, demonstrates ability to monitor, assess and react to situations behind, to both sides, and in front.	Teach the sitskier 360-degree awareness while maintaining own 360-degree awareness, proper tethering position, and tether tension. Develop full multi-tasking with lots of interaction with sitskier while tethering.
Ability to perform AOT and communicate basic teaching points to the sitskier. Can identify one or two deficiencies at a time and correctly prioritize teaching points.	Ability to perform AOT on finer ski techniques for sitskier while maintaining own 360-degree awareness, proper tethering position, and tether tension.

Excellent body position where arms and shoulders are not being compromised, back is straight, athletic stance.	Ability to retain this while allowing the sitskier to select path, speed, terrain and when to stop. Demonstrate the ability to transition from planning and executing turns and stops to reacting to sitskier's lead.
Excellent tether control (short, long, medium) how to manage the tethers according to terrain, sitskier skill, and speed.	Continue to finesse tether, changing from tensioned tethers and/or slack tethers without adversely affecting sitskier
Good use of terrain and management during different snow and run conditions.	Continue to use (and coach use of) terrain for speed control, turn initiation and completion, avoidance of patrons, safety, etc. Demonstrate varied use of terrain, snow conditions, and hill conditions.
Manages minimal tether pressure	Demonstrate use of loose tether and single-tether capabilities. Demonstrate the ability to anticipate sitskier actions prior to sitskier initiating turns, stops, or other actions. Ability to position with loose tethers and ensure correcting position for safety, assistance, while letting skier do everything. This is the precursor to becoming proficient enough to be classified as being able to tether semi-independent sitskiers.

4.4 Expert Tetherer

- ✓ Capable of tethering all sitski configurations
- ✓ May tether sitskier moving towards independence
- ✓ Capable of tethering alone without blocker
- ✓ Capable of loose and single tether situations
- ✓ All lift types including T-Bar, Pomas, and Snowmobiles

Skills Demonstrated	Skill Development
Capable of higher speeds.	Ability to adjust speed via tethers in all aspects of the turn (not just when initiating) but can apply brakes in middle of turn without dramatically affecting sitskier.
Full 360-degree awareness and initiates coaching sitskier for 360-degree awareness without impacting tethering technique.	Continue maintain full 360-degree awareness but also coaching sitskier for full 360-degree awareness.
Demonstrate proper use of a single tether to assist in braking, turn management and overall safety.	Continue to ensure proper position and 360-degree awareness to anticipate needs of sitskier as they progress to independent skiing (no tethers).
Excellent tether control (short, long, medium) how to manage the tethers accordingly for safety (e.g. wrapped and loose vs dragging on ski hill). Demonstrates finesse tether approach changing from tensioned tethers and/or slack tether and vice versa without adversely affecting sitskier.	Continue to demonstrate ability to change from slack tethers to tensioned tethers based on sitskier needs without adversely affecting the sitskier.

<p>Very confident on skis and can react to the sitskier's independent actions without impacting sitskiers control (loose tether). Fully demonstrates ability to perform AOT on fine skill requirements of the sitskier while skiing and can discuss with sitskier while in motion or stopped. Full multi-tasking with lots of interaction with sitskier.</p>	<p>Continue to demonstrate ability to perform AOT task to enhance sitskier skill development. Consider working towards tetherer instructor certification and/or CADS Level 2</p>
<p>Can provide constructive feedback to other more junior tetherer's.</p>	<p>Continue to demonstrate ability to perform AOT for other tetherer's skill development. Consider working towards tetherer instructor certification.</p>
<p>Capable of skiing the sitski while tethered and sitski independently.</p>	<p>Ability to perform AOT on tethering techniques while in a sitski. i.e. can feel the different tensions, angles, etc. of the tetherer affecting or assisting</p>

4.5 Tetherer Instructor

- ✓ Expert Tetherer (All-round tetherer; quadski, biski and mono-ski qualified)
- ✓ May instruct tetherer candidates on techniques and skill progressions
- ✓ All lift types including T-Bar, Pomas, Rope Tows, and snowmobiles

Skills Demonstrated	Skill Development
Expert tetherer skills.	<p>Continue to work on and improve tethering teaching techniques.</p> <p>Provide critical feedback and updates to reference material and instructors manuals.</p>
Expert and capable of teaching other tetherers.	
Experience in the sitski and be able to “feel” the tetherer and be able to coach occasionally from the sitski – it’s a very unique point of view and can be very useful for the finessing of a tetherer’s skill.	
Demonstrates ability to AOT (instruct) differing techniques of tethering. Demonstrates ability to use all 3 learning methods and change approach to suit students as necessary.	

5 Skiing and Snowboarding Skill Assessment

For safety considerations, CADS trains intermediate and advanced skiers, telemarkers and snowboarders to become tetherers. The drills presented below are used by the Instructor to assess a candidate's skiing and boarding skills as a potential tetherer. It will also allow the candidates to understand the types of ski/board actions required while tethering a sitski.

Successful completion of the assessment also requires the ability to ski/board in the fall line, which is a "must" for safe tethering.

Tetherer candidates may find these drills will improve their edging skills in turns and sideslips, improve timing and co-ordination of their skiing and allow for a smoother transition from a snowplow/wedge turn to sideslip to parallel skiing. For boarders, being able to demonstrate good control while using both toe and heel sides as well as being comfortable riding switch is mandatory.

To ensure safety of all involved (tetherer candidates, instructors, and sitskiers) each of these skills must be demonstrated to the instructor by the candidate **prior to tethering any sitski**.

This sequence of drills is really the first step in tethering training and the length of time spent on each step is dependent on the candidate's ability to effectively demonstrate each skill successfully.

5.1 Skiing/Telemark Drills and Competencies

These skills have been copied from the CADS Manual (Chapter 9.4)

1	Snowplow/ Wedge Drill	<p>On a beginner to intermediate slope, ski in a straight line down the fall line, and demonstrate the difference between a slightly edged snowplow (narrow ski placement) and a power plow (wide ski placement).</p> <p>Have the skier perform a snowplow/wedge drill from a narrow stance snowplow to a strongly edged snowplow to stop completely.</p> <p>Continue this exercise several times down the slope.</p>
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2	Pedal Turns Drill	<p>On gentle groomed intermediate slope, ski straight down the fall line in a snowplow position.</p> <p>Increase the pressure on the inside edge of the ski to initiate a turn. As the turn initiates, release the pressure on the outside edge and pressure the inside edge of the other ski to initiate the turn in the other direction.</p> <p>Repeat using quick initiated turns, the skier should remain in the fall line at all times.</p> <p>Skier should be able to change from a narrow stance snowplow to a more strongly edged snowplow to maintain speed as the terrain changes while doing the pedal turns.</p>
3	Skate / Hockey Stop Drill	<p>On an intermediate to advanced slope, demonstrate a hockey stop in both directions.</p> <p>Do this exercise one stop at a time.</p> <p>Ensure that the skier's upper torso is facing the direction of travel, arms forward and balanced on the skis.</p> <p>Ensure that skier stops with skis completely across the hill (perpendicular to the fall line).</p> <p>Vary distance and speed.</p> <p>Skier should stay in the fall line as they come to a stop and not track forwards or backwards, showing they are balanced forward and backward on their skis.</p>
4	Sideslip Drill	<p>On an intermediate slope, demonstrate a controlled sideslip using edges to slow down (almost stop), then release edges to slide further.</p> <p>Repeat controlled sideslip with skis facing the other direction.</p> <p>The skier will need to maintain a centered balance stance to remain in the fall line with no ski movement across the hill during this exercise.</p> <p>Skier should be able to demonstrate good edge control throughout (i.e. demonstrate a flat skis and edged skis).</p>

5	Falling Leaf Exercise	<p>The falling leaf exercise builds on the sideslip drill using an intermediate to advanced slope.</p> <p>Initiate a downhill sideslip (as describe above).</p> <p>Using slight edging of the skis, change balance minimally by moving weight to the front of the skis.</p> <p>The skis will move forward and down the slope on edge. As the skid continues forward, move weight from the front of the skis to the tail of the skis which will result in a slide backward to the side of the slope. Have patience in both directions.</p> <p>Repeat this process several times using narrow corridor.(one cat track wide)</p> <p>Skier should be able to demonstrate good edge control throughout (i.e. demonstrate a flat skis and edged skis) and a smooth progression between forward pressure to backward pressure.</p>
6	Snowplow Turn Transitioning to a Skidded-Parallel Turn	<p>On an intermediate slope, demonstrate a snowplow turn that changes at the fall line bringing the skis parallel through turn completion.</p> <p>Ensure that the parallel turn is skidded or sliding downhill through the completion of the turn.</p> <p>Repeat in the opposite direction.</p> <p>Link a series of these turns.</p> <p>Finally, skiing straight down the fall line, practice snowplow transitioning to a sideslip in one direction.</p> <p>Repeat facing in the opposite direction several times.</p>

7	Synchronized Skiing	<p>On a beginner slope, demonstrate synchronized skiing using two skiers, one behind the other, skiing in a snowplow stance.</p> <p>Begin with short radius turns staying in a very narrow skiing corridor.</p> <p>Stay very close to the downhill skier.</p> <p>Ensure that the uphill skier remains in the downhill skier's fall line.</p> <p>The uphill skier should be verbally communicating when to turn.</p> <p>Try this exercise using medium radius turns and vary the distance between the 2 skiers.</p> <p>Try these same exercises with the downhill skier communicating when to turn.</p> <p>Note: along with general ski level assessment, synchronized skiing allows the instructor to assess the skier's ability to monitor events outside of their own skiing.</p>
8	Synchronized Skiing using Bamboo Poles	<p>In this exercise, the skiers should be synchro-skiing (in a snowplow stance) in the fall line one behind each other holding one bamboo pole in each hand.</p> <p>The downhill skier must hold their hands in a rigid position.</p> <p>The uphill skier can now initiate turns for the downhill skier using by pulling/pushing on one of the bamboo poles.</p> <p>The uphill skier must be verbally communicating the turns to the downhill skier.</p>

9	Synchronized Skiing using Hip / Waist Tethers	<p>Ensure that the instructor / tetherer keeps their elbows tucked in while tethering, to promote stability and a much stronger position.</p> <p>Same as above exercise with poles, only with joined tether straps around downhill skier's hips, or using a waist harness or "Papa Joe".</p> <p>Downhill skier should hold tethers to ensure that they don't slip when uphill skier is initiating the turns.</p> <p>Uphill skier, who is verbally communicating turns, should be skiing to the inside of the downhill skier's turns at all times.</p> <p>Perform same exercise using short radius snowplow turns with uphill skier skiing in a straight line (versus in downhill skier's fall line) and using upper-body rotation to follow/tether the downhill skier. Repeat using medium radius turns (downhill skier only) and longer tether straps.</p> <p>Discuss and compare fall line tethering versus the technique used in the above drill.</p>
10	Synchronized Skiing using Hand-Held Tethers	<p>On a beginner slope, repeat the exercise similar to the above, only in this case, the tethers are held in the skier's hands similar to the bamboo pole exercise.</p> <p>The uphill skier will use verbal commands to initiate the turns (i.e. both skiers are initiating the turns, tethers are not used, but should remain taunt at all times).</p> <p>This exercise can develop to skidded-parallel turns (<i>snowplow turn transitioning to a skidded-parallel turn</i>) practiced on an intermediate slope.</p> <p>Uphill skier who is verbally communicating turns should be skiing in the downhill skier's fall line at all times.</p>

5.2 Snowboard Drills and Competencies

For safety considerations, CADS trains only advanced snowboarders to become tetherers. Unlike skiing where the snowplow/wedge can be used, edging on the snowboard provides the only braking and resistance ability. Based on fixed feet positioning on the board, balance and comfort on the snowboard is of paramount importance and the ability to accomplish 360 degree awareness without losing balance on the snowboard is required to safely tether a sitski using a snowboard.

Note: The use of toe edge while tethering is very limited, however to be evaluated as an advanced snowboard qualified for tethering, the instructor will evaluate both heel and toe side skills riding both normally and switch.

<p style="text-align: center;">1</p>	<p style="text-align: center;">Sliding and Carving turns</p>	<p>On a beginner to intermediate slope, board in a straight line down the fall line, demonstrating consecutive sliding turns and then consecutive carved turns. Continue this exercise several times down the slope, varying size of turn and slope. Start with normal stance then evaluate switch stance sliding and carving turns</p> <p>Sliding turns: any turn which has any degree of skidding (tail of the snowboard takes a wider arc than the nose)</p> <p>Carving turns: a turn that leaves a “pencil line” in the snow can be described as a carved turn (no steering angle as the tail follows the exact same path as the nose of the snowboard)</p>
<p style="text-align: center;">2</p>	<p style="text-align: center;">180 Pivots & Side slip pivots</p>	<p>On groomed beginner or gentle intermediate slope, demonstrate the ability to transition from normal riding to switch riding and back while in motion.</p> <p>Starting in a straight line run and using separation of upper and lower body, pivot the board so that you go back and forth between your normal foot forward and your switch foot forward.</p> <p>Initiate the pivots from carving turns (180 pivot), then using heel side edge, demonstrate the ability to pivot while side slipping.</p>

3	Stop Drill	<p>On an intermediate to advanced slope, demonstrate both heel side and toe side stops. Do this exercise one stop at a time. Demonstrate normal riding and switch riding stops.</p> <p>Ensure that the tetherer's upper torso is facing the direction of travel, arms forward and balance on the board.</p> <p>Ensure that tetherer stops with board completely across the hill (perpendicular to the fall line)</p> <p>Vary distance and speed.</p>
4	Sideslip Drill	<p>Heel slide slipping – sliding on the heel side edge, with both feet strapped into the board. The board is kept across the fall line as it slides down the hill; boarder maintains weight evenly distributed over both heels and can maintain a neutral position.</p> <p>Toe slide slipping – sliding down the hill on the topside edge, with both feet strapped into the board and the board kept across the fall line. Weight is evenly distributed over both feet and eyes looking uphill, body maintains a neutral position.</p> <p>Test riding normal and switch.</p>
5	Falling Leaf (Pendulum) Exercise	<p>The falling leaf or pendulum exercise builds on the sideslip drill using an intermediate to advanced slope.</p> <p>Pendulum – start in a sideslip, shift weight to right or left foot; rotate hips downhill to increase speed and create the slide down the hill. To slow down, rotate hips uphill and slowly change pressure back to equal weight between feet and then shift weight to other foot and rotate hips.</p> <p>Demonstrate Heel side then Toe side.</p> <p>Repeat this process several times using narrow corridor. (one cat track wide)</p>

6	Carved Turns transitioning into Sliding Turns	<p>On an intermediate slope, demonstrate a carved turn that changes at the fall line into a sliding turn.</p> <p>Ensure that the sliding turn is skidded or sliding downhill through the completion of the turn.</p> <p>Repeat in the opposite direction (heel side then toe side)</p> <p>Link a series of these turns.</p>
7	Synchronized Boarding	<p>On a beginner slope, demonstrate synchronized boarding using 2 boards, one behind the other, boarding in a Sliding Turns.</p> <p>Begin with short radius turns staying in a very narrow corridor.</p> <p>Stay very close to the downhill boarder (1 or 2 board lengths).</p> <p>Ensure that the uphill boarder remains in the downhill boarder's fall line.</p> <p>The uphill boarder should be verbally communicating when to turn.</p> <p>Try this exercise using medium radius turns and vary the distance between the 2 boarders. May also try with carved turns instead of sliding turns.</p> <p>Try these same exercises with the downhill boarder communicating when to turn.</p> <p>Note: along with general snowboarder level assessment, synchronized boarding allows the instructor to assess the boarder's ability to monitor events outside of their own boarding.</p>
8	Synchronized Boarding using Bamboo Poles	<p>In this exercise, the boarder/skier should be synchro-skiing (in a Heel side, sliding turn stance) in the fall line one behind each other holding one bamboo pole in each hand.</p> <p>The downhill boarder/skier must hold their hands in a rigid position.</p> <p>The uphill boarder (tetherer) can now initiate turns for the downhill boarder/skier using by pulling/pushing on one of the bamboo poles.</p> <p>The uphill boarder (tetherer) must be verbally communicating the turns to the downhill boarder/skier.</p>

9	Synchronized Boarding using Hip / Waist Tethers	<p>Same as above exercise with bamboo poles, only with joined tether straps around downhill boarder/skier's hips.</p> <p>Ensure that joined tether straps are not wrapped completely around the downhill boarder/skier. They should only form a half wrap or half circle around the front of the skier; ideally using one of the tether belts.</p> <p>Uphill boarder (tetherer), who is verbally communicating turns, should be boarding using heel side sliding/pendulum turns in the downhill boarder/skier's fall line at all times.</p> <p>Perform same exercise using short radius turns with uphill boarder (tetherer) sliding heel side in a straight line (versus in downhill skier's fall line) and using upper-body rotation to follow/tether the downhill skier. Repeat using medium radius. Turns (downhill skier only) and longer tether straps.</p> <p>Use both regular and goofy riding stances.</p> <p>Discuss and compare fall line tethering versus the technique used in the above drill.</p>
10	Synchronized Boarding using Hand-Held Tethers	<p>On a beginner slope, repeat the exercise similar to the above, only in this case, the tethers are held in the skier's hands using a "Papa Joe"</p> <p>The uphill boarder (tetherer) will use verbal commands to initiate the turns (i.e. both boarder/skier are initiating the turns, tethers are not used, but should remain taut at all times).</p> <p>This exercise can develop to heel side sliding turn transiting to carved turns practiced on an intermediate slope, the transition to carved turn should be done in a regular and goofy stance. Can also progress to the boarder (tetherer) providing resistance on the left or right tether to promote turning in skier.</p> <p>Uphill boarder (tetherer) who is verbally communicating turns should be skiing in the downhill skier's fall line at all times.</p>

6 Weighted Quadski Tethering Progression

Now that you have completed the skiing and snowboarding skills assessments, it is time to tether a sitski. When first learning to tether, you will use a quadski, weighted to simulate an athlete. This will allow you to get accustomed to how the sitski behaves and will not endanger a live athlete.

This sequence of drills is similar to the skiing and boarding assessments and are designed to build on one another. The length of time spent on each step is dependent on the candidate's ability to effectively demonstrate each skill successfully.

6.1 Equipment

The following should be used this section:

- ✓ Quadski with asymmetrical extreme short radius skis
- ✓ Appropriately distributed weight that is securely fastened into the sitski
 - Approximately 35 kg (80 pounds)
 - 60 pounds in seat
 - 20 pounds footrest
 - Ensure the weight is wrapped or taped such that it will not break open when its rolled
- ✓ Secure the weight in manner that allows the sitski to roll without the weight being dislodged

- × Don't use bags of salt (will eat snow if they break)

6.2 Tethering Progression

<p style="text-align: center;">0</p>	<p style="text-align: center;">Throughout the Progression</p>	<p>Location: Dependent on progression</p> <p>Goal: Instructor ensures following skills are explained and demonstrated</p> <p>Tetherer Skills to Demonstrate/Highlight:</p> <ul style="list-style-type: none"> ✓ Daily inspection of sitski prior to first load ✓ Tetherer assists sitski load onto chairlift from both left & right side ✓ Tetherer leads getting on the chairlift (e.g. timing, etc.) ✓ Tetherer leads the disembark from the chairlift ✓ How to position the sitski across the hill after a fall <p>Blocker Skills to Demonstrate/Highlight:</p> <ul style="list-style-type: none"> ✓ Proper following blocker position (high, inside & leading turns) ✓ Blocker points in direction of travel ✓ Communication with tetherer ✓ Blocking from the front (i.e. trail merges & lift lines) <p>Safety:</p> <ul style="list-style-type: none"> ✓ Awareness (180-degree or better) ✓ Stopping in appropriate places on the hill ✓ Appropriate use of chairlift safety bars (always use, when to put down, when to lift) ✓ Lift line safety & etiquette
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<p style="text-align: center;">1</p>	<p style="text-align: center;">Getting Started</p>	<p>Location: Beginner slope</p> <p>Goal: Run the sitski in a straight line down the fall line and come to stop.</p> <ul style="list-style-type: none"> ✓ As this is a weighted sitski, you will need to initiate the start by thumbing the sitski ✓ Create a smooth transition without jerking the sitski the tethers become tensioned. If you use a push technique, do so gently and evenly. Alternately, simply release both hands at the same time and apply tension to tethers ✓ Skiers follow the sitski using a snowplow or wedge ✓ Snowboarders follow the sitski using a heel side sideslip <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Tether length should be such that tetherer's skis are 30 cm from the back of the sitski skis (elbows at 90 degrees). Best accomplished by hitching the tethers on then wrapping equally until the 30 cm gap is achieved. <p>Highlights:</p> <ul style="list-style-type: none"> ✓ Do not have tethers so long they are touching the snow and getting tangled in your skis or under the sitski ✓ Notice how tethering from directly behind limits ability to affect edge control but is a very strong braking position ✓ Extreme short radius skis do not like to be flat for extended periods of time & get to want to grab an edge – you may experience your first “pontoon wobble”
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2	<p>Initiate Single Turns</p>	<p>Location: Beginner slope or very easy intermediate</p> <p>Goal: Initiate single turns and glide to a planned, terrain assisted stop</p> <ul style="list-style-type: none"> ✓ Smooth start to gain momentum ✓ Have appropriate tether length (30 cm between sitski skis & tetherer skis) ✓ Move to inside of the turn ✓ Using banked (steering wheel) method, apply edge to skiski ✓ Continue to turn until you come to stop ✓ Skiers follow the sitski using a snowplow or wedge ✓ Snowboarders follow the sitski using a heel side sideslip <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Play with different angles (closer to behind vs. closer to beside sitski) ✓ Vary the speeds and size of turns ✓ Left and right turns <p>Highlights:</p> <ul style="list-style-type: none"> ✓ Position affects ability to edge sitski & maintain edge pressure ✓ Stopping on a hill, if you release tension, sitski will come off edge and pivot
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<p>3</p>	<p>Planned Stops</p>	<p>Location: Beginner slope or very easy intermediate</p> <p>Goal: Develop the ability to stop using a variety of methods.</p> <ul style="list-style-type: none"> ✓ In a straight line down the fall line ✓ Skiers follow the sitski using a snowplow or wedge then stop the ski (start using snowplow stops, then progress to easy hockey stops) ✓ Snowboarders follow the sitski using a heel side sideslip <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Varys speeds ✓ Skiers: Practice both sides when using hockey stops ✓ Snowboarders should practice normal and switch <p>Highlights:</p> <ul style="list-style-type: none"> ✓ Skiers: Notice hockey stops easier and faster than snowplow ✓ Skiers and snowboarders will feel more comfortable on one side or the other; while this is expected, tetherers should be able stop using both sides
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4	<p>Introduction to Linked Turns & Maintaining Tether Tension</p>	<p>Location: Beginner or intermediate slope</p> <p>Goal: Develop the ability to link turns in a controlled manner</p> <ul style="list-style-type: none"> ✓ Link left and right turns – 3 or 4 linked turns at a time ✓ Ensure proper transition of positioning (e.g. not following the sitski as it turns) – leading the turn of the sitski ✓ Tetherers use their ski/board style of comfort (i.e. snowplow, sideslip, mixture; regular and/or switch) <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Varys speeds ✓ Vary turn shape and size ✓ Rounded linked turns vs. turns with longer traverses ✓ Demonstrate ability to have first turn as either right or left ✓ Vary timing (e.g. the instructor will call the stops as different intervals) <p>Highlights:</p> <ul style="list-style-type: none"> ✓ Reducing tether tension at end of turn allows the sitski back into the neutral position before applying tension for new edge ✓ Progressive tension ✓ Important to lead the turn of the sitski ✓ Banked tether (use of steering wheel) to assist with initiating and holding the edge turn the turns
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5	Emergency Stops	<p>Location: Beginner slope or very easy intermediate</p> <p>Goal: Develop the ability to aggressively stop in the shortest distance possible</p> <ul style="list-style-type: none"> ✓ Lengthen tethers to create a 60 cm gap between sitski skis and tetherer skis ✓ In a straight line down the fall line, generate medium momentum ✓ Skiers must use a power hockey stop ✓ Snowboarders must use a power heel side sideslip to stop <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Varys speeds ✓ Vary timing (e.g. the instructor will call the stops as different intervals) ✓ Ideally sitski is not tipped <p>Highlights:</p> <ul style="list-style-type: none"> ✓ Skiers must practice both sides – one side will feel naturally easier ✓ Snowboarders must practice normal and switch –will likely feel much more comfortable in their normal stance ✓ As tetherer, the ability to stop using your less comfortable side is critical – may not have time to switch in an emergency stop situation ✓ Good awareness and anticipation will significantly reduce the need for emergency stops ✓ Ensure hands are as close together as possible and elbows are tucked into sides (limits risk to shoulders & back and creates the strongest, most athletic position)
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6	Advanced Linked Turns	<p>Location: Beginner or intermediate slope</p> <p>Goal: Develop the ability to link turns in a controlled manner and use a variety of ski techniques as the tetherer</p> <ul style="list-style-type: none"> ✓ Skiers must demonstrate ability to switch between snowplow and skidded parallel turns ✓ Snowboarders must demonstrate ability to switch between normal and switch riding ✓ Link left and right turns ✓ Ensure proper transition of positioning (e.g. not following the sitski as it turns) – leading the turn of the sitski ✓ Change of tether lengths as speed increases or decreases <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Varys speeds ✓ Vary turn shape and size <p>Highlights:</p> <ul style="list-style-type: none"> ✓ Ability to switch ski/board styles provides versatility when tethering
7	Integrated Run	<p>Location: Variety of slopes ranging from beginner to intermediate</p> <p>Goal: Develop the proficiency at tethering the weighted sitski</p> <ul style="list-style-type: none"> ✓ Demonstrate proper positioning, tether tension, turn shapes ✓ Develop 180 degree awareness ✓ Understand terrain management and speed control ✓ Avoidance of obstacles ✓ Tether length is consistent with speed ✓ Use of wrapping and unwrapping to manage tether length ✓ Use of banked/steering wheel hand position to assist with tether tension control <p>Considerations and variations:</p> <ul style="list-style-type: none"> ✓ Change runs and paths choose when using the same run ✓ Play with different turn shapes on terrain features ✓ Instructor can interject emergency stops <p>Snowboards must practice normal and switch –will likely feel much more comfortable in their normal stance</p>

7 Understanding the Sitski

This section will focus on the most popular brand of sitskis used by CADS (the Mountain Man biski/quadski) but does have some guidance for other types of sitskis as well.

7.1 Articulators

All biskis have articulators. This is a mechanical device connecting the sitski frame and the skis that enables the two skis to angle equally when the sitski is turning allowing both edges to make even contact with the snow. On the Mountain Man sitski it is one of the common failure points and should be inspected before use. It should be checked daily to make sure that it is not cracked and is operating correctly.

7.2 Centering Device

Centering devices assists the articulator in returning to an upright (flat ski) position. Not all biskis will have this type of device.

Mountain Man: Also known as the Articulator Feathering Device or the 'donut'. The centering device is a large rubber bumper mounted to the base plate of the articulator. It works in conjunction with a plastic sliding ramp to create the desired resistance. By sliding the ramp completely or partially under the rubber bumper you can increase the return force. Leaving the ramp free of the bumper allows for the least return force. On the Mountain man sitski the ramp may work its way free of the bumper over a short period of skiing so should be checked regularly.

Dynamique and Bi-Unique: The centering device is the same as the Mountain Man and fixed at the back of the articulator but the ramp can still be moved from under the bumper.

7.3 Chair Lift Load Assistance Mechanisms

Many sitskis have mechanisms to allow for easier loading onto the chairlift. These allow the sitski bucket assembly to lift away from the articulator and skis to provide a more generous opening for the chairlift seat to fit under the sitski bucket and possibly lock in the loading position. The Mountain Man is purely a manual lift with no locking mechanism, the Dynamique and HOC have a hydraulic assistance device and physically lock in the load position and the Bi-Unique has a hydraulic jack to pump the seat into the load position and hold it there. Section 13 (Sitski Models) describes each sitski and whether it has a lift load assistance mechanism. A number of mono skis use a link over-centering device that will lock it in the load position until the chairlift seat resets the linkage.

7.4 Shock Absorber Locking Devices

All manufacturers of sitskis that have Chair Lift Load Assistance Mechanisms have something to lock the sitski into a skiing position. This prevents the ski from opening up while on the hill (potentially caused from large bumps, jumps or falls) to a load position, which increases the risk of injury to the sitskier or damage to the sitski. When skiing, the sitskier and/or tetherer should always ensure that the locking device is in place, so in the event of a fall the sitski does not wind up in the load position. Conversely, when being prepared to use a chairlift, the sitskier and/or tetherer should ensure that the locking device is disabled.

Mountain Man. The locking mechanism is a pin through the frame with a looped retainer that holds the pin in place preventing it from vibrating free while skiing. This pin goes through the main frame of the sitski just forward of the shock and is used to lock the shock in the upright position while the sitski is being skied. With the pin installed the sitski will not be capable of being loaded onto a chairlift. This pin permits the shock to operate in the position it was designed for while skiing. By limiting the range of the expansion of the bucket in relation to the skis it has the advantage of keeping the upper and lower section of the sitski together which makes righting the sitski after a fall much easier. It also makes putting the sitski back into the storage rack less cumbersome by holding the two sections together.

Dynamic & HOC: These sitskis use a lever to lock and unlock the load-assist mechanisms.

7.5 Foot bucket/retention system

The foot retention system is normally a frame with strapping to hold the feet in place. The actual style varies by the sitski model and manufacturer. The Mountain Man has a fixed foot bucket that cannot be adjusted while the Dynamique and HOC sitskis have foot buckets that are adjustable for length and angle. The Dynamique and HOC give a bit more adjustability when trying to balance the sitskier on the ski. Most monoskis have adjustable foot retention systems.

7.6 Seat Bucket

Seat Style: The seats of sitskis come in two basic types: fixed back and clamshell. As the name indicates, seats, like those used on the Mountain Man, that do not adjust and are rigid at about a 90-degree angle, are known as 'fixed back' seats. The Dynamique and HOC sitskis have 'clamshell' backs. These seats have independent bottoms and backs connected by a hinge or pins allowing them to be adjusted to fit the sitskier's requirements and therefore allow the back to be adjusted to different angles, not only for skiing but also for riding the chair lift. Clamshell seats should be released back to about a 90-degree position for lift loading and comfort of riding on the lift. If the straps are not loosened the sitskier will be in an uncomfortable forward position. When at the top of the hill, be sure to readjust the clamshell to the ski position (i.e. forward). Seat buckets are normally offered in various widths for comfort and proper fit. The seat buckets in most cases are capable of being moved fore and aft to help balance the sitskier.

Seat Dump: Dump (or "rake") is the term used to describe the angle of the seat from front to back. The higher performing sitskis come with ability to change the dump setting so the front of the seat can be lowered or raised in 2 or 3-degree increments to adjust to the individual user. Typically, athletes who have use of their abdominal muscles and/or hip flexors will have less dump (flatter slope front to back) than an athlete that does not have abdominal muscle control. Mountain Man sitskis do not have an adjustment. The Dynamique and HOC Glide sitskis do have adjustments. Please discuss any changes with the Equipment Manager or Program Coordinator.

Seat Padding: Most sitskis come with a padded insert for the seat bucket for comfort and for thermal protection. Padding of the sides of the sitski will be discussed in the section on fitting a sitskier.

7.7 Shocks

Shock. Almost all sitskis have some sort of shock absorber to absorb impacts. Shocks can differ greatly in size, shape, functionality and capabilities. They range from a basic compressed gas or air shock, as found on the older Mountain Man biskis to coil-over shocks with adjustments for sag, rebound and compression. All shocks will perform differently based on temperature: most significant being stiffer and less absorbing in colder temperatures. Some shocks, such as the older Mountain Main air shocks can freeze if the temperature is sufficiently low and thereby offer next to no shock absorption.

Preload or Sag plays a huge role in how the full suspension works on a sitski. It is the distance that the shock settles when on the ground and under the load of the rider's weight. i.e. When the sitskier sits in their sitski, the shock will sink a certain amount into its travel – this is referred to as preload or sag. The recommended sag for any shock is approximately 30% of its total travel. Therefore, if the stock is capable of travelling 6 inches, the sag should be approximately 2 inches. Having sag will mean that there is room for the shock to work correctly and that the shock is not set to be too stiff for the skier.

Mountain Man air shock. The only adjustment is the air pressure in the shock. There are no official charts to determine the correct PSI for a given weight of sitskier so CADS uses the method of compressing the back of the sitski by pushing your weight down once the sitskier is sitting in the sitski and feel for a return that brings it back to original position with little delay. Seek guidance from an experienced tetherer if uncertain on the return. At the top of the shock just below the seat there is a schrader valve (like a car tire). To inflate remove the valve cover attach the shock pump and pump to the desired pressure. To remove air, simply press the small pin in the centre of the valve. Note: the air volume in these shocks is very small, so even a minor amount of air released or added can have a big effect on how the shock operates. It is easier to control the pressure using the pump as opposed to releasing air. Using nitrogen in these air shocks will reduce the likelihood of the shock freezing but increases the difficulty in adjusting the shocks to meet the skiers weight.

Mountain Man Coilover Shock. The coilover shock is comprised of 2 components a coil spring and a gas shock. The coil attaches over top of the gas shock to help smoothen the ride and create a better return rate. There are three different spring rates available based on the weight of the sitskier using that sitski. These can be changed by a technician and you should ensure you are using a sitski with the correct rated spring.

Red: Sitskier weighs over 85 kg (185 lbs.)

Green Sitskier weighs between 68 kg and 85 kg (150-185 lbs.)

Blue: Sitskier weighs less than 68 kg (150 lbs.)

In addition, there is a rebound adjustment at the base of the shock that will allow you to adjust the shock rebound rate i.e. how quickly the shock returns to its extended position after being compressed. If the rebound adjustment is set too slow, successive bumps may not get absorbed and if set too quickly will adversely affect the sitskier's ability to ski in control by throwing them off balance (e.g. "pogoing"). Again, a compression of the back of the sitski will give a very good idea of how the ski will react.

Do not adjust the compression/rebound adjustment of any shock without discussing first with a technician or instructor.

Dynamique and **HOC** Coilover Shocks. These shocks have adjustments for sag, rebound, high speed and slow speed compression. Do not adjust the compression/rebound adjustment of any shock without discussing first with a technician or instructor. You should simply know that these adjustments are available, and the ski can be tuned for an individual. The springs for the Dynamique are labelled 300, 400 or 500 and need to be halved to meet the sitskier's weight. A 150 lb. sitskier needs the 300 lb spring.

Bi-Unique. This sitski is a bit different from the others as there isn't any suspension other than the flexing of the frame. There is a shock but it's attached to a pump handle which is used to raise the seat into the load position for the ski lift and provides no suspension.

7.8 Tethers

Most tethers are about 14 feet long, manufactured from 1-inch tubular nylon having a tensile strength of 4000 lbs. and is the preferred material for use with sitskis. The material resists rot, are wide enough so they don't dig into your hands and thin enough that multiple wraps can be held in your palm. There are sewn loops on each end of the tether which must be professionally sewn with bar tacks and weather-resistant thread to create the loops. The loops are best made too small to fit over a hand but just large enough to permit a girth hitch (tether pushed through the loop) to work. This makes it harder for people to just insert their hand through the loop and also keep the girth hitch from loosening. The tethers need to be inspected before each use for excessive wear or cuttings in the nylon (a single pass of a sharp ski edge could cause considerable damage to the tethers). Tethers are attached to the sitski with locking carabineers or using a "girth hitch" to the proper attachment point. All sitskis have tether attachment points that have been engineered and should be the only points to attach tethers. Because they are designed to be skied independently some mono skis are not designed with dedicated tether points and some creativity may be required to find an available position that permits the mono ski to be tethered while not affecting the sitskier or movement of the linkages. This would almost certainly likely be using a single tether.

Tethers are to be girth hitched to either the tetherer's lower arm or wrist to ensure a secure connection. Simply slipping your hand through the sewn loops is not sufficient. The two independent tethers gives two attachment points to the body and is mandatory within CADS. There are other methods of attaching tethers to the tetherer such as by waist belts and continuous tethers with a sliding attachment point. The double attachment points is the safest and most widely used.

Tether Storage: Bags can be attached to the back of each sitski where the tethers can be stored when not in use (e.g. on chairlift, in the shed, or for an independent sitskier). Gathering the tethers into a fan-like shape before putting them into the tether bag will assist with a no knots extraction. If no storage bags are available the tethers can be wrapped around the instructor bar above the back of the sitski or a sitskier's jacket hood may also a handy place to store the tethers on the way up the hill (be sure to talk to the sitskier before you use their hood!).

7.9 Straps

All sitskis have straps or buckles that allow an athlete to secure themselves into the sitski. There are also additional safety straps for evacuation and assistant/tetherer/instructor straps. It is important to note that a number of straps on the Mountain Man sitski and not all of them are used in all situations.

Waist, Thigh and Feet Straps. These straps are always used by all sitskiers. The waist, thigh and foot straps are all done up with the buckles in the centre of the body and fairly snug. These are the straps that will hold the sitskier in place in the seat and make them rigidly attached so they can manoeuvre the sitski without slipping around in the seat. When done up properly these straps will hold the sitskier in place and allow the sitski to move as one motion to their body. Think of the sitski as a ski boot to a stand-up skier movement will lead to blisters and does not permit effective skiing.

Note: loose straps that have more than ½ inch of play (1-2 cm) poses a safety risk if the ski comes to sudden stop.

Chest or Abdominal Straps. Chest or abdominal straps are used to hold a sitskier in the upright position when they are unable to accomplish this on their own. Unlike the waist, thigh and foot straps, the chest and shoulder straps may be loose. The elastic chest strap allows the sitskier maximum movement that gives them freedom to assist in skiing more independently by aiding in returning to a neutral position. The chest strap should be adjusted to keep the athlete from falling over to one side or flopping forward onto their knees.

Shoulder Straps. If the chest strap gives insufficient support the shoulder straps can be used to keep the sitskier centered and upright. Since there isn't any give to the shoulder straps the sitskier will have limited mobility. If someone has sloping shoulders and has trouble keeping the shoulder straps up, crisscrossing the straps across the chest can be effective. Try to allow the sitskier the maximum amount of useful range of motion, depending on their abilities.

Evacuation Straps. All sitskis are designed to have evacuation straps. These straps are not used for skiing but are required for safety purposes in case a chair-lift evacuation is required. Most sitskis have a 3-point evacuation harness designed to keep the sitskier upright (flat or slightly leaning back) in the event of an evacuation. Single point harnesses may or may not keep the sitskier balanced (note: single point harnesses are usually found on race/advanced mono ski setups). Evacuation straps should be examined before use for wear or damage. A climbing-rated, locking carabineer is required and connects the 3-point harness together. For single point harnesses, a climbing-rated locking carabineer must also be used. In all cases, the evacuation straps must be connected and accessible prior to using the chairlift and need to be connected in a way to ensure they are outside of all other straps. Some sitskis like the Dynamique and HOC the evacuation straps are accessible while sitting on the chairlift so the evacuation straps stay rolled and connected to the frame. Note: In all cases where evaluation is necessary, the sitskier and tetherer will follow the instructions provided by the rescue team.

Assistance Straps. These straps are attached to the sides and back of the sitskis and are designed to aid an assistant instructor or even chair lift personnel to assist in righting a sitskier or loading on a chairlift. Many advanced or racing sitskis will not have these assistance straps available.

7.10 Fixed Outriggers

Fixed outriggers (aka pontoons) are designed to create a “quadski” set up and limit the amount of lean a biski has during a turn. The overall stability and turning radius of the sitski is dramatically affected by how the fixed outriggers are set up. The following describes the impact of each variable:

Mountain Man. The fixed outriggers are installed by passing the outrigger bridge under the front portion of the frame and aligning the bridge of the outrigger with the holes in the frame. The long bolt goes through both sides of the frame and is secured with a butterfly nut. Details below on which whole should be considered.

Fore and Aft. Ahead of the shock mount, there are two sets of holes through the frame that allow for the fixed outriggers to be placed more forward or aft on the frame. The main difference is the more forward position will allow a slightly tighter turning radius compared to the farther back. While there is not a large improvement, it will allow the ski to carve into the hill more and shorten that radius. Consideration on which alignment should be used can be determined by the terrain, conditions, weight of the person in the sitski and tetherer skill. One big advantage to the fixed outriggers being in the forward position is they are less likely to impact your shins during loading on the chairlift.

Up and down. At the end of the fixed outriggers there is an up and down adjustment for the height of the outrigger skis above the snow. If the skis are lower, the sitski will not be able to lean as much and therefore it will make longer radius turns. A lower outrigger ski setting may be good for flatter terrain or for new sitskiers to limit the amount of lean they are able to achieve. The lower setting also means a longer turning radius which can make a sitski more difficult to carve across a slope because the uphill outrigger ski will be on the slope earlier. The height of the outrigger ski is not a quick adjustment because they do not have quick release pins and when the bolts are removed they are difficult to insert into the holes due to the holders becoming distorted over time.

Do not attempt to adjust these settings yourself! Please discuss with the Program Coordinator or Equipment Manager.

Lateral adjustment (In/Out). The outrigger skis are attached to a square tube that fits into the fixed outriggers. Simply removing a retaining pin will permit the small skis to be repositioned closer/farther from the sitski. Much like the up and down adjustment the further out the small skis are positioned, the larger the turning radius and similar results can be achieved with a combination of height and lateral positioning of the outrigger skis. When making this adjustment, you must consider the turns made on a steeper pitch will have the uphill outrigger hitting before it would on flat slopes. Once the outrigger hits the snow, the sitski cannot be edged any further which can make for an excessively long turning radius to the point the sitski cannot be angled directly across the hill.

Rear pontoon setup (Mountain Man) – CADS-NCD (Edelweiss) has modified some of their Mountain Man sitskis to accept the fixed outriggers at the back of the sitski. They attach in the same manner as they normally would with the two long bolts and wing nuts. The rear fixed outriggers have the advantage of permitting someone to use handheld outriggers and also having the support of fixed outriggers attached. This is a good step to

transition from a quadski to hand held outriggers. Because the outriggers are further from the centre of mass of the sitskier turning on these rear outriggers is not as balanced a turn as using the fixed outriggers in their normal position. Ideally a sitskier at this level of development should avoid using these outriggers and they act only as a safety mechanism.

There are four situations that need to be watched for when using this configuration:

1. When loading the sitski onto a chairlift the position of the outriggers makes getting into a good lifting position a bit more difficult and often the volunteers get trapped behind the outrigger.
2. When unloading at the top of the chair lift the volunteer taking the sitski off may get their leg caught between the body of the sitski and the fixed outrigger.
3. There is the potential for the hand held outriggers to drift back and get stuck in the fixed outriggers while skiing.
4. During loading and unloading the outrigger skis can get stuck on the underside of the chair in the strapping or cords holding the chair seat cushion.

Dynamic and Bi-Unique. The Bi-Unique has fixed outriggers that are at the rear of the sitski but are not designed overly well and are frail and tend to bend easily. The Dynamique used the same fixed outriggers as the Bi-unique but now has its own specific fixed outriggers which mount in roughly the same location as the mountain man fixed outriggers and operate in much the same fashion. The small skis on the end of the fixed outriggers are spring loaded to point upwards in the front when they are not on the snow and the springs dampen the impact on the outrigger and give a more progressive feel. With them being spring loaded it is difficult to pull the sitski backwards as the rear of the small ski digs into the snow.

HOC Glide Biski. The Hands-On-Concepts (HOC) Glide biski fixed outrigger set up is similar to the Mountain Man configuration but there are key safety considerations that must be realized. With the HOC, the fixed outrigger attachment point is removable.

The attachment hardware must NOT remain on the sitski when not in use (it prevents the full angulation of the biski and makes the ski unsafe for a sitskier using hand held outriggers).

Attach the fixed outrigger mount to the middle tube between the ski mounting frames (just aft of the shock mount). Clip in the 2 fixed outriggers (tips forward).

Up and down. At the end of the fixed outriggers there is an up and down adjustment for the height of the small skis above the snow. If the skis are lower the sitski will not be able to lean as much and therefore it will make longer turns. Use the D-ring to change the height of the fixed outrigger)

In addition to the standard adjustments on any of the biskis there is the possibility to setup the fixed outriggers asymmetrically or with one hand-held and one fixed outrigger.

Asymmetric setup. Not all sitskiers are able to turn right and left equally. This provides the potential to have asymmetric settings on the outriggers. While it is unusual, a good example would be a sitskier that has full use of their left side but minimal on the right. Having a handheld outrigger on the left and a fixed outrigger on the right may maximize their freedom

and independence. Or changing the fixed outriggers to permit more lean in one direction than the other would also be an appropriate adjustment for some athletes.

7.11 Handle bars

Handle bars should be used for all quadski setups (i.e. when using fixed outriggers) and should not be used for athletes using handheld outriggers. These are often (incorrectly) referred to as “roll bars”.

Mountain Man handle bars come in 2 sizes and are “U-shaped” – one for the adult sized sitskis and one for the junior sitskis. They slide into 2 holes on either side of the seat and are securing via a D-ring on each side of the seat. There is no adjustment required for fore/aft or height on the Mountain Man handlebars.

HOC Glide biski, Dynamic, and Bi-Unique handlebars are “T-shaped” and connect to their mounting point between the sitskier's leg using a D-pin. Adjust the handle bar to a comfortable height for the sitskier.

7.12 Sitski Skis

There are two main types of skis used for sitskis. Banana skis (extreme short radius asymmetrical skis) and parabolic skis.

Extreme Short Radius Asymmetrical Skis. Also known as “**Banana skis**”, they are asymmetrical, tight-turning parabolic skis. They generally have an outside turning radius of 6-8 metres. The inside of the skis are designed to work with the articulator and therefore have a radius 4-6 metres. These skis should NEVER be used on a mono-ski as they are left and right specific and must be used as a pair. The term ‘banana skis’ was first coined as the original skis featured a bright yellow top sheet and the skis have an aggressive banana-like curve. Today, most of the ‘banana ski’ manufacturers do not use a bright yellow top sheet but are easily recognized by their asymmetric shape.

Parabolic skis. Standard parabolic skis can be used on biski and mono-ski setups. Some manufactures (e.g. HOC) also sell standard parabolic skis (e.g. turn radiuses between 10 and 20 metres). Generally speaking, biskis should use parabolic skis with a radius of between 10 and 16 metres, unless they are advanced, and the terrain is wide-open.

Bindings. All sitskis should use either the manufacturer-specific custom bindings designed so they cannot release from the sitski or should use metal, very high DIN (18 to 30) settings to minimize an inadvertent release. Unlike stand-up skiing where you need to protect joints by releasing when excessive force is applied you do not want the skis to separate from the sitski as it will probably result in a tumbling sitski and sitskier which is dangerous. Many older biskis use a custom ski-binding system that physically locks the ski to the sitski with a spring loaded bale that is pretty much fail proof. To remove the skis you need to lift the bale and push the ski towards the front. If the skis have not been removed recently a bit of rust may have developed and a tap with a rubber mallet may be required. Many of the newer biskis and monoskis use a “standard” binding system: in these cases, the binding must either be locked with a pin or be set to a minimum 18 DIN, preferably with an all metal binding including metal heel and toes pieces.

7.13 Handheld Outriggers

Handheld outriggers are the ski poles used by independent or semi-independent sitskiers (and other athletes). They most commonly have short ski tip attachments at the end.

Flipable Handheld Outriggers: The outrigger skis can be flipped up and down. In the up position (crutch), they act like ski poles and can be used for “picking” around and or lifting up after a fall or onto the chair lift. Superlite is the most common brand of flipable handheld outriggers for both stand-up skiers and sitskiers. The flip action is most commonly activated by a cord under the handgrip that allows the athlete to control whether the outrigger is in the crutch or ski position. The springs that flip the ski can be set as either flip up (typically race mode) or flip down (recreational mode). Refer to the CADS Manual for fitting an AOT considerations.

Fixed Handheld Outriggers: Handheld outriggers where the ski is permanently attached to the end of the pole and does not move. Originally these were used more by racers and expert skiers as they needed to be custom built. Today, as fixed outriggers are becoming more commercially available, sitskiers of all abilities are liking their simplicity, lightweight and durability. They are still adjustable (length and ski angle) to be tuned to an individual sitskier but this is done by nuts and bolts and therefore AOT before getting onto the hill is very important.

7.14 Daily Checklist

Assuming your program has preassigned and pre-fitted the athletes to the sitskis, there are a number of items that must be checked daily for safety reasons:

- ✓ All straps are in good order, including the evacuation straps
- ✓ Tethers are attached (ask your instructors how many times they have gotten to the top and realized they have no tethers!)
- ✓ The shock works! Before the athlete sits in the sitski, test the shock. After the athlete is in the sitski, retest the shock to ensure the correct sag
- ✓ Correct skis are installed and in good condition
- ✓ Overall mechanics (angulator, lift assist mechanism/pins, etc.)
- ✓ Outriggers are in good working condition
 - Fixed outriggers – check the ski tips to ensure there are no cracks
 - Handheld outriggers – check skis & ability to pull into crutch vs. ski position

Where possible, have the athlete perform or assist with retrieving and examining the equipment. Having athletes participate from the “get-go” promotes independence and helps develop the full experience.

7.15 Outrigger gloves/mitts

These are gloves/mitts specifically intended for use with handheld outriggers. They include extra straps and Velcro to attach the hand to the outrigger when the skier has insufficient grip strength. If these adaptive gloves/mitts aren’t available many times the low-tech use of duct tape, Velcro or ski straps can be used to accomplish the same thing. It is important to note that use of the upper arm and shoulder must be possible, or the outrigger will be pushed behind the sitskier and can cause shoulder injuries.

8 Safety Considerations

8.1 Helmets & Goggles

Helmets are mandatory for both sitskiers and tetherers.

It is highly recommended that all sitskiers use goggles while skiing and especially when in, and around, lift lines or other congested areas (e.g. top of the ski lift). It should be noted that sitskiers are at a height where swinging ski poles are at head/eye level.

8.2 How to Hold the Tethers

With the exception of single-tether tethering the **tethers must be attached to the tetherer** in a manner where, in the event of a fall, the tethers cannot become unattached. This will ensure the tetherer becomes a brake or an anchor if they fall and there is no possibility of a “run-away” sitski. Simply hanging onto the ends of the tether is not considered safe.

The optimum method for accomplishing this is to:

- ✓ Loop the tether through itself (Girth Hitch) around either your wrist or forearm with the straight part inside of the arm, in a way so that when you wrap the slack around your hand the girth hitch cinches around your wrist and the tether exits parallel to your thumb as it goes to the sit ski.
- ✓ Do not place the girth hitch above your elbow as there is then a direct pull on your shoulder. With the loop over your forearm there is some force absorption with your lower arm, and therefore less risk to your shoulder joint.
- ✓ Adjust the girth hitch above your gloves. A failure to do so could result in the runaway sitski if the gloves are being pulled off during a fall.
- ✓ Wrap the slack around your hand, so the girth hitch tightens while being wrapped. This slack should be taken up under tension and equal on both hands so that each palm has a tight wrap of equal loops. Starting with unequal tether lengths is very uncomfortable and may lead to unintentional tension on the wrong tether.
- ✓ There should be a couple of feet of excess tether between the tetherer and sitski which gives you a good starting position when you release the sitski. While some slack is good, too much slack where the tethers are dragging on the snow is inviting the tethers to get caught around parts of the sitski or around parts of the tetherer’s ski binding.

Never tether a sitski down the hill without proper tether loops over your wrist or forearm.

Never use the “simple” loop method, even if the loop of the tether is big enough to slip your hands through. Pass the tether through the loop and use the Girth Hitch loop over your wrist or forearm.

8.3 Combined weight (athlete and sitski)

Empty sitskis weigh between 16 and 23 kg (35-50 lbs.). Add the weight of the sitskier and even with lighter athletes, the combined weight can approach 90 kg (200 lbs.). Tetherers must factor the total weight for stopping distances and speed of acceleration when heading downhill. Additionally, the weight of the combined sitskier and sitski can have significant impact to

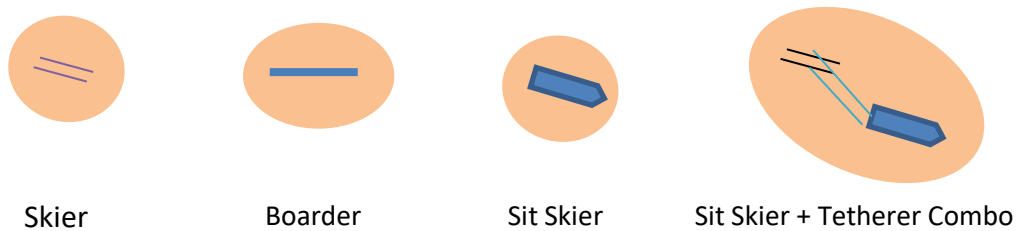
another person using the hill in the case of a strike. It is always best to stay as far away as possible of other skiers, boarders and other sitskis. It will take more distance to execute an emergency turn or stop given the combined weight of the sitskier, sitski and tetherer.

8.4 Combined skiing area (sitskier and tetherer)

An average skier will ski on skis 170 cm long – meaning their overall footprint is a circle about 2 meters in diameter. The average snowboard has a 155 cm board, but because of their stance they are more of an oval footprint of approximately 2 meters. Independent sitskiers also have an average footprint of 2 meters as the average skis used are 175 cm or less.

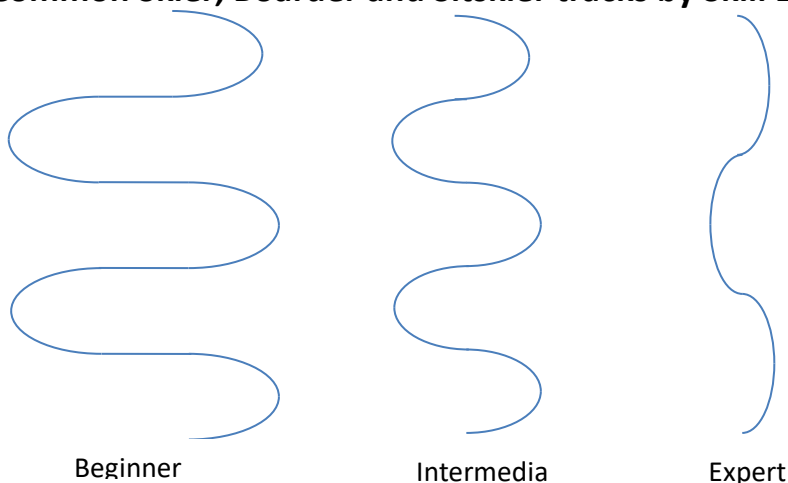
A tethered sitski takes up much more relative hill space. A typical biski is approximately 2 meters. Add to that the tetherer (another 2 meters) and then add the length of the tethers; approximately 1 to maximum of 4 meters. This means that even in a close tether situation a tethered sitski takes almost 3 times more physical space of an average skier or boarder. In a long tether situation, where the sitskier is going faster and requires more tether, the footprint is almost 4 or 5 times the average skier area.

Relative Footprint of skiers, snowboards and sitskiers



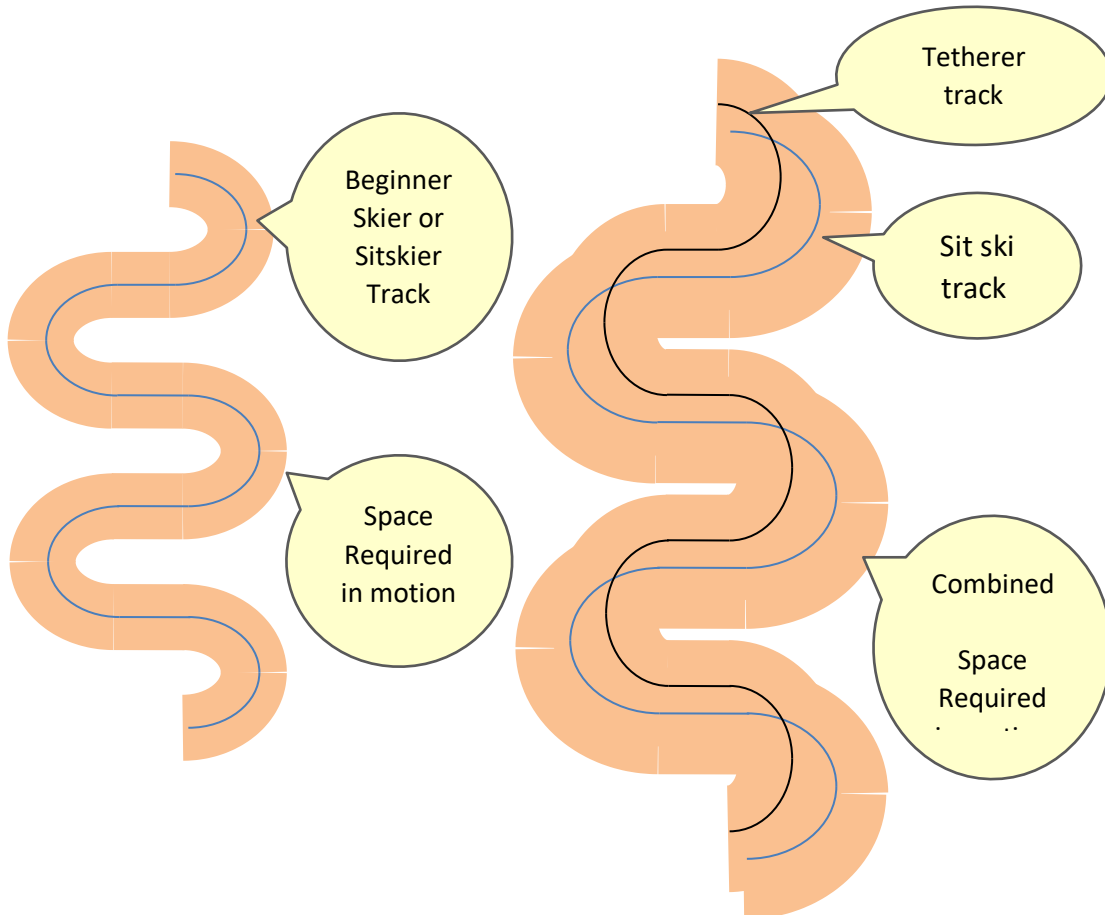
The overall relative size doesn't account for the skiing/boarding style being used or the skill level of the athlete. More advanced skiers/boarders will tend to be faster and create turns more directly down the fall line (using less of the hill). Beginners and intermediate patrons will tend to traverse across the hill and therefore use much more of the hill.

Common Skier, Boarder and Sitskier tracks by Skill Level



What does this look like down the hill? Most tethering situations will call for a beginner to intermediate turn styles (i.e. longer, more across the hill). This coupled the facts that a tethered quadski set up generally has a long turning radius as well with the larger combined footprint, planning your route and having good situational awareness for what is going on around you is paramount.

Space required when skiing – skier vs sit ski + tetherer



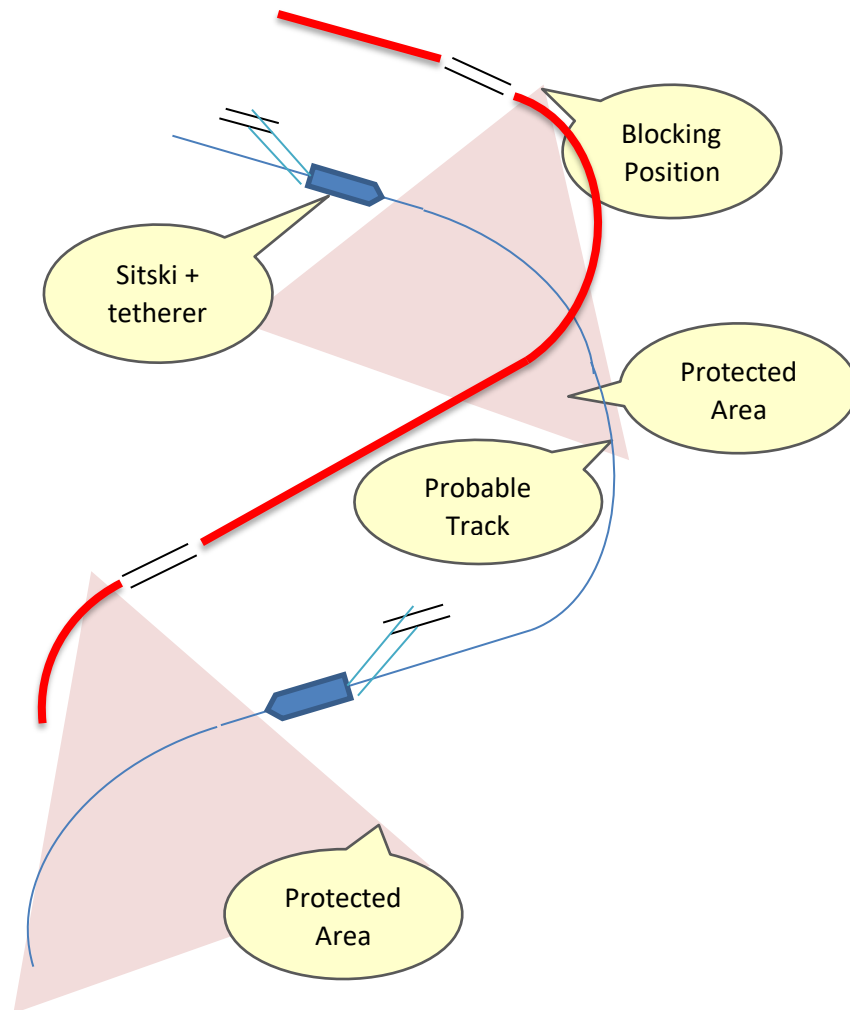
8.5 Blocker/Ski Buddy/Lifter/Second/Assistant

The roles of the blocker/assistant are many and go from assisting to load and unload the sitski, to ensuring the sitskier does not ski off unanticipated, or helping to right the sitskier after a spill to actual blocking duties to ensure other users on the hill stay clear of the sitski.

Blocking is not like American football where the assistant is expected to physically tackle or engage other patrons of the ski hill. In this role they are acting in an intervention or obstacle role to improve safety for both the CADS members and the general public.

Blocking from behind. Blocking from behind (or uphill of) the sitskier and tetherer is the most common position. The goal is to lead the turns and provide an additional layer of space and protection uphill for the sitskier in the direction they are about to turn – keeping other patrons away from the intended path of the sitskier. It does take anticipation and teamwork to keep ahead of the pair.

Blocker Path when Blocking from Behind



Blocking ahead: Occasionally the blocker can be used ahead of the sitski/tetherer pair. Some examples of this includes skiing ahead to provide an “all clear” where trails merger, going over a blind crest or when approaching a lift line. Once the sitski has passed, the blocker can resume their normal ‘blocking from behind’ function.

Often the blocker/assistant is new to CADS and will require close supervision and maybe a bit of training to assist the tetherer. Always make sure the two of you operate as a team and lots of communication is necessary. Snowboarders skiing with their back to the sitski often fail to clear their heel side turns and can get in the way unexpectedly.

8.6 Tetherer Falling

If a tetherer falls they should alert the sitski by immediately yelling “STOP”. Ideally the sitski is capable of independent stops and they are not dragging the tetherer down the hill. However, in many cases, the sitski will not be able to stop independently and will rely on the anchoring or dragging effect of the tetherer to stop. Whether the sitski is capable of independent stops or not, the action of the tetherer calling for a stop alerts the sitski of a problem.

8.7 Thumbing, Bucketing or Bucket Assist

Thumbing is controlling a sitski by standing directly behind it and holding on to the back of the seat (also known as the “Bucket”). It’s called “Thumbing, Bucketing or Bucket Assist” because a common grip is to place the hands palm forward, with the fingers outside the bucket and the thumbs inside. These days a growing number of biskis have a handle attached, so the natural grip is more like pushing a shopping trolley, though still referred to as “thumbing”.

There are not issues thumbing when pushing the sitski across flat ground, such as from the chalet to the chair lift. It becomes more controversial when you use thumbing as the primary method to get a sitskier down a hill. A sitskier who is being thumbed isn’t controlling, or even contributing to, their direction or balance. This means that not only is the sitskier not learning anything, they are also not getting the athletic, physical workout of skiing, and the tetherer is doing much more work than necessary.

There are some circumstances where thumbing is useful:

- ✓ When demonstrating the amount of lean that the ski must make to affect a turn, how long to hold a turn, balance points, etc.,
- ✓ When entering and exiting the chairlift, especially for quadski setups, and
- ✓ In very slushy snow conditions when the water stops the sitski quickly causing slack tethers.
- ✓ Very flat terrain that will cause the ski to slow to a stop.
- ✓ In powdery conditions, when tension on the tethers is next to impossible to keep consistent

Thumbing is different than tethering and needs to be taught so that we do it in a safe manner. Normally thumbing is done with the tethers attached to the tetherer with the two notable exceptions: getting to the lift on flat ground and when off-loading from the chairlift at the top of the hill.

Turning is done by leaning the sitski in the direction you want to turn and stopping is done by turning up hill or doing a skidded turn to a hockey stop with the tetherer and sitskier being one unit.

When thumbing it can take much longer to initiate and perform a stop in an emergency situation. It also limits the view of the tetherer, limits their situational awareness, and drastically increases the consequences of a crash as there is no chance for the tetherer to separate themselves from the sitskier. During an emergency stop because there is no distance between the tetherer and the sitskier, there is a significant chance of colliding, creating a risk of injury for both.

As with any physical contact with another person; thumbing should be done with consent and must be communicated to the athlete prior to initiation.

In conclusion, thumbing is a short-term assist or instructional tool and is not a ski technique to be used throughout a run.

8.8 Incident Management

Things happen. We train to be safe. We train to ski with our heads on a swivel and to ski and tether under control and to be part of the general public having fun on the slopes. Things happen and whether big or small, we need to manage these situations accordingly.

Firstly, any physical contact, even minor contact such as a tap or skiing over another patron's skis or board must be reported to the program coordinator. This is not to get you, as a tetherer, in trouble, but is critical to maintain the CADS reputation and relationships with resort operations and management. Tethered sitskiers are very visible on the hill and while the general public is becoming more accustomed to seeing them sharing the slopes, some still, incorrectly, feel they are unsafe or should be limited to times or segregated runs. Program Coordinators need to know what has happened on the hill in order to work with the resort effectively.

8.8.1 Minor Incident (No Ski Patrol or Hill Staff involved)

- ✓ **Remain calm**
- ✓ Ensure all parties are ok
- ✓ Even if it was the other party's fault, never engage in accusations or arguments
- ✓ Report the incident at your earliest opportunity to your Program Coordinator

8.8.2 Major Incident (No Ski Patrol or Hill Staff involved)

Any incident where a Ski Patroller or any hill employee is on scene is considered a major incident. Hill employees can include lift attendants, ski instructors, and mountain guides.

- ✓ **Remain calm**
- ✓ Ensure all parties are ok
- ✓ If there are injuries
- ✓ Even if it was the other party's fault, never engage in accusations or arguments
- ✓ Report the incident at your **immediately** to your Program Coordinator

8.8.3 What to do in the case of injury

If you get into a situation where the sitskier is injured and the ski patrol has been called and is on scene your first priority is to stay with your sitskier. Send your blocker or another patron to get Ski Patrol onto the scene. It's also a good idea to have them inform your CADS program coordinator that assistance is required and where on the hill you are located.

While, many ski patrollers have been trained to treat persons with a disability, most will have limited experience with sitskiers. Consider the following:

- ✓ **Remain calm**
- ✓ **Ensure you are in a safe position on the hill and are visible** – if you are not visible from above, use a blocker to prevent other skiers and boarders from hitting you
- ✓ Do not move the injured person – this reduces the risk of further injury
- ✓ Provide the ski patrollers with any relevant medical or disability information needed

- ✓ Allow the sitskier to answer questions and provide information before offering to patrollers, i.e. do not speak for your sitskier unless required
- ✓ Not every incident requires the sitskier to be removed from the sitski and transported down to the bottom using the toboggan – even with a more serious shoulder injury, stabilizing the shoulder in the sitski and then having an expert to instructor level tetherer thumb the sitski to the medical clinic may be safest and most expedient manner
- ✓ Assist but don't interfere with the patrollers
- ✓ **Never remove both tethers! If the sitskier is still in the sitski, at least one (1) tether remains attached to your wrist at all times!**
- ✓ If you are injured and can no longer tether, ensure that a qualified tetherer replaces you and assists the sitskier to the bottom – always ensure that there is someone attached to at least one (1) tether at all times!

8.8.4 In case of broken equipment

Unfortunately, equipment does break. Buckles, skis, outriggers and shocks will all fail at some time or another. While we can try and reduce the number of times this happens on the hill with good preventative maintenance, and pre-ski reviews of the equipment, as a tetherer you will find yourself in a situation where equipment has failed.

Can Ski It Down:

- ✓ Carry on down the run and head to the equipment room
- ✓ Inform the program coordinator or equipment manager of the failure
- ✓ Follow your local program's protocol regarding using spare/replacement parts

Cannot Ski It Down:

- ✓ **Get into a safe position in the hill** – if you are not visible from above, use a blocker to prevent other skiers and boarders from hitting you
- ✓ Send someone for assistance. If it is safe to do so, use your blocker. If not, send a patron to contact the CADS program coordinator/desk or Ski Patrol
- ✓ If not already completed (i.e. Ski Patrol assisted you down), inform the program coordinator or equipment manager of the failure **and** the fact that Ski Patrol assisted
- ✓ Follow your local program's protocol regarding using spare/replacement parts

9 Assisting a Sitskier into a Sitski

Most programs will have setup the sitskis for their athletes prior to the start of the season and this will be accomplished by experienced instructors. The CADS Instructor Manual (Section 9.4) has some excellent information on how to assess a sitskier for mobility and strength and is the information that is used to determine what type of sitski is most appropriate for the sitskier. Following a fitting, the information such as type of sit ski, length of outriggers and configuration should be recorded on a student's progress reports so that the sitski can be setup in an identical manner for each session. It is not expected that a junior sitski tetherer to have the knowledge to make these decisions independently.

9.1 Assisting the Sitskier

Once the sitski has been properly setup for the sitskier it is time to help load the sitskier into the sitski. Like all aspects of helping persons with disabilities it is essential to allow them to do as much as they can independently: ask if you can be of assistance and how best you can assist.

Gaining consent to physically assist the athlete is critical and must be observed at all times.

If they can stand allow them to do that with assistance if necessary and lower them into the sitski. If they can stand it is sometimes very helpful to put the sitski into the chairlift loading position, move the sitski to the standing sitskier whose legs need to be slightly parted and allow them to sit on the sitski. Once they are properly aligned allow the sitski to go back to the ski position. If an assisted transfer is required, again let the sitskier do as much as possible and assist as necessary. If a full transfer is required, then it is best accomplished with a minimum of two people. One to reach around from the back, grasping the opposing wrists while the second person lifts from behind the knees. This is not always easy especially from a large motorized wheelchair past the back of the wheelchair and sitski. If there are family members/caretakers available it may be best to ask for their assistance, as they will have experience with that sitskier.

There are a few other considerations for sitskiers that you need to be aware of. Since the sitskier is rigidly attached to the sitski at least from the waist down there is little movement of the lower extremities so they are prone to getting cold quicker than you as a tetherer. A good rule of thumb is that if you are cold the sitskier is probably colder.

Some sitskiers have little to no sensation and/or limited circulation in the lower extremities. In these cases, they may not realize if they are cold. Frostbite is therefore a risk and if not caught early, can become an issue.

There are sitski specific blankets available that look much like a sleeping bag but fit easily into a sitski and on colder days stay incredibly warm inside. There may be circulation issues as well caused by overly tight straps which can also add to cooling of the body but also medical issue from lack of circulation.

Check the straps often. When possible, have the sitskier do the checking. It is very common for the straps to loosen over time and this can allow the sitskier to move in the bucket, increasing the risk of abrasion sores and will definitely reduce the athlete's ability to control the movement of the sitski.

Always make sure that there is a finger gap at the front of the sitski bucket between the seat and the underside of the thighs. Having any pressure here will be very uncomfortable if they have feeling in that area. It also poses a medical and safety hazard. In order to correct for this, the sitski's footrest may need to be moved up or additional blocking under the feet will be required to ensure there is a small gap between the legs and seat.

9.2 Order of Straps

Doing up the straps in the correct order will help the sitskier to be balanced (square) in the seat and ensure optimum positioning. The suggested order of the straps are:

1. Waist strap
2. Thigh strap
3. Foot strap
4. Chest/Abdominal strap (if applicable)
5. Shoulder straps (if applicable)
6. Chairlift evacuation strap (if applicable, such as on the Mountain Man)

9.3 Common issues to watch for

Regardless of who set up the sitski at the beginning of the season once the sitskier has made a run or two the set up may be inappropriate for comfort, fit, type of ski, shock etc. This feedback may be best expressed by the sitskier or the tetherer and should be heeded and corrected. For junior or newer tetherer's this may be best addressed by more seasoned tetherer's. If the program has supervisors, they may be your best contact to make an assessment as to what needs to be done.

Common issues to watch for:

- ✓ Sitskier has difficulty remaining upright
- ✓ Movement within the seat (i.e. not enough padding)
- ✓ Too much pressure under the legs (i.e. foot plate set too long)
- ✓ Sitskier can only turn one way or has more difficulty turning on one side
- ✓ Suspension is bouncing (like a pogo stick) or is jolting (i.e. little or no suspension)
- ✓ Equipment failures or wear and tear
- ✓ Lack of upper body movement or difficulty breathing (i.e. chest straps done too tight)

If you are not sure or you suspect an issue, don't be afraid to approach an instructor – they can help detect and correct if they are made aware of a potential issue!

10 Working with Lifts

Your hill management or CADS Program Coordinator will provide you with the list of approved lifts for tethered sitskis at individual program hills.

All lifts are governed by safety and technical standards and are regularly inspected. Some of this includes a standard distance between snow and chair seat and is approximately 50 cm *. Many hills experience a fluctuation in this height due to snowfall. Many ski patrons, not only sitskiers, find that spaces greater than 50 cm/20 inches between snow and chair creates a more difficult load and unload.

* ANSI standard (**ANSI B77.1-2017**) regulates all North American passenger ropeways: chairlift heights should be 46cm +/- 5cm (18" +/- 2") from the ground surface to the top of the seat break over at the load line. If the chair height is not within standards it must be posted before you get on the lift.

10.1 Chairlift General Points

When using chairlifts with sitskis and tetherer or assistants, there are a few practical points to consider:

- ✓ Triple chairs or greater work best
- ✓ Chairs without footrests for stand up skiers work best
- ✓ If chairs do have footrests, be sure to align the sitskier between or beside the footrests to allow the safety bar to come down
- ✓ While fixed-grip chairs are feasible, detachable chairlifts are much easier to use particularly for sitskiers that require assistance

ALWAYS ride with the safety bar down and do not raise it too early.

10.2 Detachable vs. Non-Detachable Chairlifts

A detachable chair lift is by far the easiest chair to load and unload a sitski from as the speed is drastically reduced while the chair is detached from the faster main cable. It normally permits lots of time to get the sitski positioned and the lifters prepared to do a coordinated lift. A non-detachable chair lift at full operating speed can be difficult to move in place and get ready to lift. Note that all chair lifts can be slowed down to accommodate the loading of children, beginners and other patrons requiring a slower speed. Using this slower speed for the load of a sitski is strongly encouraged.

This is something that can be coordinated with the hill if a CADS program is run there or communicating with the lift operator as early as possible.

Depending on the offload ramp, keeping the chairlift speed at “full speed” may make offloads easier as it provides additional momentum to assist with sliding the sitskier off the chair. If the ramp is very short or very steep, slowing the chairlift to half speed may be required. As with the load, be sure to communicate your needs to the lift operators early. Although there may be a possibility of alerting the lift operator at the top of the hill, it is best to request the bottom lift operator to radio ahead on your behalf. Often the lift operator at the top is more difficult to get their attention as they are watching the dismount area more than the arriving lifts.

10.3 Lift lines

Many ski hills have special entrances for their ski schools, instructors and ski patrollers that allow quicker, shorter access to the lifts. Often times, these hills also allow the CADS programs to make use of these access points for limited mobility clients and sitskiers.

It must be noted that this is a privilege and not a right. Being respectful of other patrons at the hill, the patrollers and ski schools will help ensure that the CADS programs maintain good relationships with the general public and with hill management.

If your ski hill does allow for sitskiers to use these shorter lines and there is a significant line-up are, take your turn with other patrons, don't simply jump the queue. Hill management is allowing CADS to make use of these lines for safety and convenience purposes and the privilege can be revoked at any time.

It is also a safety concern with beginners swinging poles around right at eye level for someone in a sitski.

10.4 Getting onto a Chairlift

Practice lift. Always do a practice lift before entering the lift-line. This ensures the sitskier and/or lifters are coordinated, the sitski does not have any issues with separating and ensures any safety pins have been removed.

Observe the lift. Before entering the lift line with a sitskier for the first time let them observe others loading from as close as possible. Bring them to a position beside the lift let them watch others load on the lift. Discuss what each person's role will be when it is your turn at the lift; sitskier, instructor, helper and lift operator. Note: this is also a good practice for the first load of the day on each chairlift. As previously discussed, the height of the chair relative to the snow surface can change on daily basis.

Move into position. One volunteer will push the sitski to the load position from behind the sitski. Just before getting into the loading position the volunteer pushes back from the sitski steps over the back of the skis and gets into the lifting position. It is best to load behind the normal indicated load line to make sure you have a little extra distance in front of you should a misload occur.

Lifting procedure. Although there are many places that can be grabbed on a sitski to permit it to be lifted onto the chair lift the tried and true method is: inside hand at the rear of the seat at hip level and outside hand on the handle bar (if present) or the front strap by the thighs. This will permit the lifting to be accomplished with the lifters body facing as forward as possible allowing the lifting to be accomplished with the backbone aligned in its strongest position.

Always lift with your knees – never your back!

It is possible to lift too high, just as it is possible to not lift enough. If you lift too high, the skis can be raised off the ground and get jammed in under the chair as it approaches you.

Remember practice the lift before getting in the lift line.

Sitski load assist. Some sitskis have a load assist feature while others are “fixed” and rely on the athlete to raise themselves into the correct position to sit on the chairlift. Make sure any shock absorber locking devices have been removed or disengaged. Snowboarders will ideally be able to load in both the regular and goofy positions. Or two snowboarders who ride opposite (one regular, one goofy) can face the sitski, grip the provided handles and lift safely by using the knees and not twisting the back.

Loading. One person counts down, the sitski gets lifted together allowing the chairlift seat to go under the sitski. The lifters sit down and at the same time pull the sitski fully onto the seat. Once the sitski and both lifters are comfortably on the seat lower the safety bar then adjust the sitski position so that the ski is all the way back, and relatively centered on the chair. Some people lift the sitski then sit themselves down and pull back from a seated position. Ideally you should not have to pull back with a twisted upper body as this puts significant strain on your lower back.

Pull back. At some hills the lift operators can assist by giving a pull back on the sitski while it is being loaded. There needs to be two lift operators present as one must always be able to quickly reach the emergency stop button should anything go wrong during the loading process. Although most loads can be accomplished with two volunteers it is a nice safety feature to have that extra person just in case.

Missed load. Occasionally a load will go wrong. This may be caused by forgetting the pin, missing a hand hold, not lifting high enough, lifting too high, frozen mechanism, etc. Whatever the cause, sitski and/or tethers do not make it onto the chair cleanly. When this happens there is very little time to reset and do another load so best to abandon the load and alert the lift operator to stop the lift. Yell “STOP”; do not assume that the lift attendants will automatically stop the lift.

Abandoning a load. Abandoning a load is where the lift is continuing to move and the sitski and or tetherers are not completely on the lift. If you need to abandon, abandon early and swing wide of the lift if possible. If you fall, lie as flat as possible and allow the chair to go over you, keep your head down and protect your sitskier. Stay down until the lift has stopped. Remember there are chairs after the chair you were trying to get on. If the lift has not stopped, it is also coming over top of you.

Loading after a missed load/loading onto a stopped chair: Loading onto a stopped chairlift is possible, however be aware the chair does not have momentum and can easily swing back when pulling the sitski onto the chair making the load a bit more difficult. Accept as much help as can be provided but don't panic and rush the reload.

10.5 Riding the Chairlift

Riding the chairlift with a sitski is very similar to riding a chairlift with any other patron. The restraining safety bar must be down. Ideally the bar will remain down from station to station (i.e. as long as possible)

Whenever possible, try and have the chair balanced. If the sitski is loaded at the centre of the chair with 1 lifter each side the chair should hang level naturally. If the chair is tilted to one side this indicates an imbalance in weight and may make for an uncomfortable ride for the sitskier.

Important safety considerations: Sitskiers sit higher than most skiers on the lift. This is because they are in a seat and the frame/seat is on the chairlift. This means the following:

- ✓ Any weight on the safety bar (people leaning on it or resting their feet on available footrests) can mean the bar is cutting off circulation for the sitskier's legs (where the safety bar crosses the thighs) – not all sitskiers will be able to feel their legs, so tetherer must watch out for this situation.
- ✓ The sitski frame can be more slippery or less slippery than ski pants on the lift. This depends greatly what the chair is made of or covered with. A good rule of thumb is that bare wood or plastic is much more slippery for sitskis than pants and that highly padded covers tend to be much less slippery (lots of resistance).
- ✓ Whereas most patrons stand up to get off the lift at the top, sitskiers most commonly need to slide off.

Some programs use an additional safety strap to secure the sitski to the chair. This strap is attached to the back of the sitski and is passed around the chairlift back and then clipped back onto the rear assistance strap using a climbing-grade carabineer. Your program coordinator will indicate whether this is a requirement for your program or hill.

10.6 Getting Off a Chairlift

Communicate with lift operators to let them know at the bottom and they can radio to the top if you would like a slowdown while off-loading. Most sitskis can be off-loaded at the top of the lift quite easily. By simply tilting the back of the sitski it will normally simply slide off and hit the off load ramp in the skiing position. The sitskier can assist by using their arms and upper body to create momentum to assist with an off-load and to prepare them for independence. Chairlift cushions are sometime made of material that will create a lot of grip so children will not slide off as easily. In this case the sitski may have to be pushed off of the lift or at least be given some initial momentum to break the holding force of the sticky seat cushion. Although off-loading itself is a very simple and easy process it is also one of the most vulnerable times because neither the tetherer nor the assistant have tethers attached. Communication is key here as well. Prior to getting off the chair lift both volunteers and the sitskier must know their role for the off load. If the person who has the responsibility of getting the sitskier off the lift falls a runaway sitski could result so it is best to pull the sitski over if a fall does occur. The sitski can be controlled coming off the lift by skiing on either side and simply tilting it to turn. It is however, much better to get into a position directly behind the sitskier to have much better control and makes turning in either direction much easier. Dismounts from either side of the sitskier should be perfected as some assistants may have shoulder issues that force them to one side of the sitskier for the lift.

Go to a flat portion of the hill and stop the sitski across the fall line with the second in front of the sitski holding it level if required but mainly making sure it doesn't turn downhill and ski away before tethers can be put on.

10.7 Chairlift Evacuation Procedures

The first step is to ensure you and the sitskier are kept as warm as possible as the time to be evacuated may be significant depending on where you are in the evacuation process. All sitskis have a built in evacuation straps that can be used in conjunction with the gear used by the Ski Patrol or hill operators that will be conducting the evacuation. The built-in straps will ensure the sitski will remain either level or with a slight backwards incline to ensure the sitskier is comfortable and will not exit the sitski on the way down. On the Mountain Man sitski it is the three straps that are done up last and are always accessible while on the lift. Evacuating the sitski is very much like taking a stand up skier off with a couple of small differences. The rescue party will have a large rope over the chair lift wire and will raise a carabineer to you on the lift. The sitski will be lowered second. One tether will be lowered first, then the sitskier in the sit ski, so that the tetherer can help receive the sitskier on the ground and keep them from taking off on their own. Basically it's a matter of attaching the carabineer from the end of their rope through all 3 attachment points. When the carabineer is attached and locked signal the ground crew that you are ready for the lowering process to begin. They will tension the rope, which will lift the sitski off of the chair. You will need to swing the sitski sideways to clear the chair for lowering. When the sitski gets to the ground make sure someone is holding on at all times so it doesn't ski away unattended.

10.8 Surface Lifts (Magic Carpet)

Magic carpets are excellent for teaching skiers and boarders of all abilities including sitskiers. Things to keep in mind when using a sitski on a carpet are:

The ski will need to remain upright and stable for an extended period of time so it will be beneficial for an instructor to stand behind the ski and help with balance.

The transition on and off the lift can jolt the sitskier and throw them off balance. This is further reason to have an instructor nearby or directly behind the ski to provide support.

If the lift is busy, which can be the case during lessons, ruts can form onto and off of the lift making it challenging to balance the ski as you approach or disembark from the lift.

Having a sitskier with a sitski and an instructor together causes a great deal of weight in a single location on the lift. If the lift is already at capacity this can cause the lift to stall. To avoid this allow for considerable distance between you and the previous patron (more than the normal recommendation) before loading on the carpet if you are loading with a sitskier. This distance can be as much as 5 meters after the previous patron and have at least 5 meters after the sitskier/tetherer has loaded.

Beware of the placement of outriggers at the top of the lift. Have your sitskier place their outriggers to the outside of the carpet as you reach the top. There is an emergency brake as the carpet returns under the lift at the top, if the outrigger touches this brake the lift will stop making it more challenging to disembark from the lift.

Magic carpets generally lead to good beginner terrain and these lifts are often less intimidating for a first time sitskier. They are a great way to introduce a sitskier to their first runs.

10.9 Surface Lifts (T-bars and Poma lifts)

It is possible to use all surface lifts when sitskiing and tethering a sitski. That being said, ensure that your local hill and CADS Program Coordinator have approved the use of the surface lifts for independent sitskiers and tethered sitskiers.

Only Expert and Instructor level tetherers may use the surface lifts such as T-bars and poma lifts with sitskiers requiring assistance.

Most manufacturers of sitskis have a surface lift mechanism that can be used. They all have slightly different attachment points and mechanisms, however they all have the following in common:

- ✓ **A quick release:** no sitskier may be permanently attached to the surface lift in such a way that the sitskier (or tetherer) cannot quickly and safely release the tow mechanism and prevent the sitskier from being dragged up the hill. Therefore the lift mechanism have a rope or strap that can be used by the sitskier or tetherer to activate the quick release.
- ✓ A rope or strap that connects to the quick release mechanism and wraps around the poma or T-bar – this is what creates the tension and pulls the sitskier up the hill

It should be noted that many CADS programs remove the surface lift mechanisms from their sitskis to reduce weight and reduce moving parts when not in use. Before heading out on the hill ensure the surface lift tow straps are in place and function correctly (i.e. can quick release).

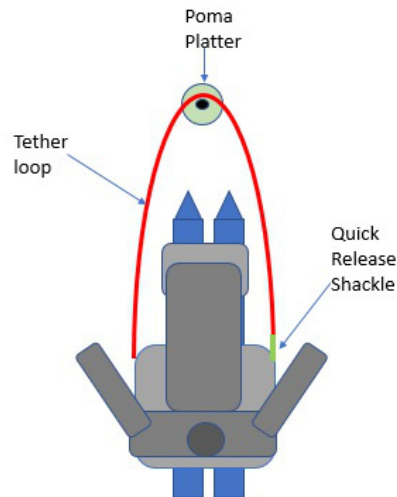


Examples of quick release mechanisms

How to use a surface lift:

1. In the line, prepare the surface lift tow/quick release mechanism
2. Request the lift operator to stop the poma/T-bar at the line
3. Place the tow strap around the poma or T-bar and ensure there are no tangles

Never wrap the strap around the pole 360 degrees.



Example of the strap and quick release

4. Get in position behind the sitskier and stabilize the sitski (i.e. thumb the bucket). If the sitskier has handheld outriggers, they should be in ski position and helping to balance themselves.
5. As the tetherer, ensure that you have easy access (ideally hanging onto) the quick release strap.
6. Ask the lift attendant to start the lift (be prepared for a jerk as the lift starts).
7. Proceed up the lift, maintaining as straight a line as possible.
8. In the event of a fall, release the quick release as soon as possible and clear the tracks immediately. Be sure to call "FALL" and hopefully the lift attendants will stop the lift and allow you to clear the tracks. NEVER attempt to re-attach to the lift mid-way. Ski to the bottom and try again or find a chair lift.
9. At the top, wait until you are on the flats and then release the quick release. Ski immediately out of the tracks and make way for other skiers/boarders on the surface lift.

10.10 Surface Lifts (Rope tows)

Tow ropes are trickier than poma and T-bar lifts for sitskiers, especially when a sitskier is tethered. As with poma and T-bars, ensure that your local hill and CADS Program Coordinator has approved the use of the rope tow for use by independent sitskiers and tethered sitskiers.

Independent sitskiers:

1. Approach the rope tow.
2. Request a stop for the rope tow.
3. Grab the rope using the "inside hand" – NEVER go to the inside of a rope tow. If you cannot grip the rope-tow using the "inside hand" do not use this lift.
4. Request the lift operator to start the rope tow (be prepared for a jerk upon the start).
5. Use the outside hand to stabilize (i.e. run your outrigger on the snow) for stability.
6. At the top, release and ski out of the track.

In the event of a fall, let go of the rope immediately and ski out of track as quickly as possible.

Only Expert and Instructor level tetherers may use the rope tows with sitskiers requiring assistance.

Tethered sitskiers/tetherers:

1. Approach the rope tow; wrap and stow the tethers.
2. Request a stop for the rope tow.
3. Grab the rope using the “inside hand” – NEVER go to the inside of a rope tow. If you cannot grip the rope-tow using the “inside hand” do not use this lift.
4. If the sitskier can assist by holding the rope, do so and have them balance by using their outriggers or outside hand as much as possible).
5. As the tetherer, use your outside hand to thumb the bucket and your thighs should be tight to the back of the sitski/bucket to provide support and the push required.
6. Request the lift operator to start the rope tow (be prepared for a jerk upon the start).
7. At the top, release and ski out of the track.

In the event of a fall, let go of the rope immediately and ski out of track as quickly as possible.

10.11 Gondolas and Trams

Gondolas and Trams may be used by Tetherers certified as Intermediate and above.

The use of gondola or tram is relatively easy if the right equipment is available. Avoid the use of a gondola or tram if:

- ✓ The athlete is required to get out of the sitski.
- ✓ Requires lift attendants or tetherer to carry the sitskier onto the lift.
- ✓ No protection is available for the skis (nobody should be skiing on damaged or dull edges).

Many hills will have a dolly similar to a furniture mover available. The sitskier can ski right up to the edge of the lift line and can be lifted from the snow onto the furniture mover and then wheeled to gondola or tram. Most gondolas have seats that can flip up and this will provide room for the sitski. You do not need to take off the ski(s) from the sitski in the scenario. It is a good idea to have the bottom lift attendant call the top attendants with the car number. This will help ensure that they are available to help you and the sitskier exit the car.

At the top, simply exit the gondola/tram and the furniture mover is sent back to the bottom.

Alternately, many sitskiers and programs have sitski transport devices that allow a sitski to be transported easily. They come in several different forms ranging from 3 wheeled aluminum trolleys to skateboards. These transport devices have one thing in common – a ski binding mounted in the centre.

These transport devices can also be used to access a gondola or tram. The only difference to the use of a wheeled platform (“furniture mover”) is that the sitskier must clip out their ski(s)

and clip into the transport device. This makes the transfer a little more challenging and can also pose challenges for the athlete to balance as they make their way on or off the gondola/tram.

10.12 Snowmobile

When sitskiing was first invented, the only way to get up the hill was by snowmobile. Now that sitskis have progressed, this method of gaining altitude has become less and less required. However, there are times and slopes where snowmobiles may be required or preferred to allow sitskiers to access higher elevations either due to lack of chairlifts or due to time constraints.

As with all other surface lifts, ensure that your local hill and CADS Program Coordinator have approved the use of the snowmobiles for independent sitskiers and tethered sitskiers.

Only Expert and Instructor level tetherer may use snowmobiles to assist a sitskier to higher elevations.

The sitskier must NEVER be attached to the snowmobile without a quick release mechanism.

Independent Sitskiers – refer to Poma/T-bar lift.

Tethered Sitskiers/tetherer:

1. Approach the stationary snowmobile; wrap and stow the tethers.
2. Place a rope or strap around the back of the snowmobile and attach it to the quick release mechanism.
3. SAFETY NOTES:
 - ✓ The sitskier should be at least 5-8 feet behind the rear tracks of the snowmobile.
 - ✓ The tetherer must never attach the rope to the sitski in a way that prevents a quick release.
 - ✓ The tetherer should not wrap the rope around their hand in a manner that does not allow for a quick and safe release of the rope.
4. Either sitskier or the tetherer will be holding onto the quick-release strap
5. As the surface lift mechanism is taking all the force, the tetherer can thumb the sitski – both getting pulled up the hill and also providing additional balance/support
6. Request the snowmobile operator to start off slowly (be prepared for a jerk upon the start).
7. At the top, quick release the tow rope.

In the event of a fall, let go of the rope immediately

11 A Run from the Top of the Hill

11.1 Setup at the Top of the Hill

Put on Tethers. Remove the tethers from the bag on the back of the sitski and make sure they are untangled with no knots. Using a girth hitch, attach tethers over your wrist or forearm. **TIP:** While you are putting on your tethers, this is a great time for the sitskier to be working on their balance and/or ability to keep themselves upright. Most times, there is no need for the tetherer to do “all” the work.

Goal or Objective of the Run Discussion. If you didn’t decide on which run you will do and what you want to work on for this run while on the chairlift then it should be talked about now so everyone is on the same page. Plan the run out in your head to decide what terrain features you would like to use, areas of concern (e.g. merging runs), a quick last check of straps and you should be ready to ski.

Most teaching and discussion is best done on the chairlift but remember not everyone is going to be a Paralympian and teaching should reflect that. Nudge but don’t shove a sitskier to a higher level.

Sometimes teaching is best disguised as discussion rather than being directed. e.g. “How about we try that nice little knoll on the left and see how long you can lean into the hill and keep climbing up?” It gets them to hold an edge with body position and have some fun doing it.

Keep the discussion short – no more than 2 points to remember.

Remember. The tetherer is responsible for the run. If you feel uneasy about how the run is going, or if you feel it unsafe, immediately stop your run. Talk to the sitskier, refocus on the objective. Only once you’re convinced that the run can be resumed, should you ask the sitskier to continue.

Engage the sitskier – as a tetherer we are here to assist the sitskier in skiing; we are not skiing for them!

11.2 Starting To Ski

Your hill management or CADS Program Coordinator will provide you with the list of approved runs for tethered sitskis at individual program hills.

Starting the run. Once you are ready to start skiing direct the sitskier in the direction you want to go and this can be accomplished by flat turning the sitski to the intended direction.

Whenever possible, have the sitskier complete or assist in this task. Best to point the sitski directly down the fall line. From there you can initiate a turn in either direction while still thumbing at this point. Once you have a bit of speed, the sitski can be released with a small push, or let gravity separate you from the ski so you can have tension on the tethers as soon as possible.

11.3 Communication

Talk, talk, talk while learning. Now that the sitski is moving it's time to continue coordinating yourself and the sitskier. This is important because all parts of the moving puzzle must work together. It is always best to make sure everyone is doing the same thing together because unintentional separation of the sitskier and tetherer can lead to one or the other or both falling.

The turns can be controlled by the tetherer or the sitskier and it takes some time to be able to anticipate each other's movements. New tetherers often find it easier to call the turns in order to ensure they are in the right place at the right time and able to consistently slow and turn the sitski.

Long radius turns with controlled speed are best. It should be noted that tethering a sitskier too slowly can be more difficult than going too fast. Slow speed tethering tends to lead to the sitski that is very hard to balance, which can bounce from side to side off the fixed outriggers, and too fast has much higher consequences if a fall should occur. There is a happy medium.

While over-coaching/over-instructing is a thing, over-communication while skiing/tethering is not, especially for a less experienced tetherer and newer sitskiers. While skiing, it is not appropriate to use longwinded explanations: simple, precise commands work best. Continuing to communicate simple messages will allow for a team approach to skiing. For example: LEFT ... LEFT ... KEEP GOING LEFT ... OK, NOW LETS GO RIGHT, HOLD YOUR RIGHT ... STAY RIGHT ...

Refer to CADS Manual (Section 9: Teaching Techniques) other Key Verbal Command suggestions.

11.4 Stopping and Speed Management

Stopping. This is one of the first things that must be learned in order to keep the tethering training safe for the new tetherer, the sitskier and others on the hill.

There are three types of stopping: Planned Gravity-assisted stop, Planned Stop and Emergency Stop.

Planned Gravity-assisted stop: As the name suggest, this is an orchestrated and coordinated stop using a combination of edging and gravity. The sitski is placed on edge and the turn is continued until the sitski is arced up the hill and gravity assists in slowing the sitskier down. The tetherer should be uphill of the sitski to keep turning the sitski in one direction, applying progressive tension on the tethers until the tetherer and the sitskier come to a stop. It is important that the sitski is not pointing up the hill at the very end or the sitskier will start to go backwards. The tetherer may or may not use a braking action to assist in slowing the sitskier.

Planned Stop: A coordinated, planned stop that involves either using a power snowplow or pivoting the ski(s) perpendicular (sideways) to the fall line and engaging the uphill edge of the ski(s) (i.e. a hockey stop). This stop requires the active participation of the sitskier and is most often completed by semi-independent or independent sitskiers. As a tetherer, your role is fairly limited in assisting with this type of stop because the sitskier needs to get the sitski side slipping and then progressively add edging to bring the ski to a stop while maintaining balance. You should still be in the proper position with tethers barely slack so that you can potentially keep the ski from a high sided fall if the sitskier catches a downhill edge.

Emergency Stops: Any stop that is unplanned is required to prevent an imminent crash or collision. Independent or semi-independent sitskiers should use an aggressive hockey stop whenever possible. As a last resort, a controlled sliding fall (to the uphill side) can be used to stop quickly.

For biskis or quadskis an emergency stop **requires a full hockey stop from the tetherer**. *With the tetherer in the correct tethering position, emergency stops are just controlled stops done much faster.* The tetherer needs to be in the correct position to effectively stop the sitski quickly and safely. Being out of position and trying to stop the ski with the same, sudden hockey stop from the tetherer can result in the sitski high siding or suddenly changing directions and not coming to a complete stop. Any stop should be done with the upper arms close to the body where they are strongest, with elbows at 90 degrees pointed at the bucket, and the lower body should have a low, wide stance, A tetherer must be able to perform emergency stops in either direction.

There are some tips that can aid in ensuring a tetherer is always in position to effect a stop safely and quickly:

- ✓ The tetherer's skis must be on the same edges as the skis on the sitski. If they are not, there will be quick separation of the tetherer and sitski which will result in sudden changes of direction for both the tether and sitski once the tethers go tight and not result in a controlled stop and increases the risk of injury
- ✓ Override the sitski's turns if you see something that you feel is not safe.
- ✓ Learning how to control your positioning and tether tension while side slipping means that in an emergency all that has to be done is to progress from side slipping to setting the edges of your skis.

Of course, the best way to safely and effectively perform an emergency stop is to not have to perform one! To reduce the need for performing stops tetherer should consider:

- ✓ Speed Management – Keep to a speed that you know you as the tetherer in conjunction with the sitski can perform an emergency stop at any time.
- ✓ Always look well ahead of the sitski and plan your path for the next couple of turns and communicate those intentions to the sitski ahead of time.
- ✓ Stay away from the edges of the slope if possible, toying with the margins isn't worth it, a bump or icy patch could alter your control quickly and your escape routes are halved.
- ✓ Do not go over a blind crest with speed as there could be a person just over the crest and the extra 10 to 12 feet between the sitski and tetherer may not permit an effective turn or stop to avoid an accident.
- ✓ Like any skiing use common sense when picking a place to stop, choose one where you can be seen from far up the hill.
- ✓ Use the terrain to your advantage, control speed by going across the slope or even climbing a bit if necessary.
- ✓ A biski and monoski sitski will use skidded turns as a method of speed management so teach it if that is appropriate.

When teaching new sitskiers it is best to use a beginner (green) slope to do small straight runs to a gliding stop and introducing a turn across the hill to a planned gravity-assisted stop.

11.5 Use of Terrain

There is no perfect tethering position and no perfect tension for all situations – they are constantly changing variables given the constantly changing environment (weather, snow conditions, how busy the hill is, pitch, etc.).

Flat Terrain (slow speeds). It is generally harder to balance a sitski on flatter terrain, especially at slower speeds (same concept as riding a bike). At these slow speeds, only very small changes in tension left and right are needed, depending on the sitskier's ability to balance. Most tetherers will find that close tethering and small changes in tension coming from just the lower arms with the tetherer directly behind the sitski will provide the best outcomes for straight running on flats. Minimal rearward tension on the tethers will limit braking forces and keep speedup. If you feel you are going to grind to a halt, by being close to the sitski, you can grab the handle to support the skier if needed and help push them until the pitch increases

Flat Terrain (faster speeds). As speeds increase, long, gradual, incomplete turns can be used to maintain speed but allow the parabolic skis to edge. This will give the sitskier and tetherer more control and allow the tetherer to move further back by unwrapping tethers one wrap from each hand at a time while still maintaining tension) and towards the inside (~15-30 degrees) to be in the right correct position to assist with holding that turn, and ready to perform an emergency stop. Too much speed control in this position would just result in the ski coming to a stop, so only small amounts of tension are required for turning purposes.

Steeper Terrain. As the terrain gets steeper, the potential for speed increases. Holding turns for longer will have the front of the sitski moving across the fall line and not straight down the hill. Also using the terrain to slow the sitski is the goal, so being on the inside of the turn to help with holding an edge is key. Being able to apply braking tension to that speeds remain appropriate for the sitskier, so 30- 45 degrees to the inside allows for both assisting with edge control and braking)

Tips for speed control of the sitski:

- ✓ Minimize having a sitskier crest a knoll with the sitski pointing straight downhill. Have the sitskier turn before or after the crest allowing the skis to be across the hill as terrain gets steeper. This will minimize the sudden acceleration.
- ✓ Come further to the side of the sitski (30- 45 degrees) when tethering on steeper slopes. In this position you are able to manipulate the sitski's speed and edge control at the same time.
- ✓ Correct for speed early – never let the sitskier get into a run-away situation in the first place. Managing speed before it becomes too difficult is the best way to remain safe and promotes the best learning environment for the sitskier!

As the speed increases or terrain gets steeper, you are going to need additional braking forces to slow the sitskier if they aren't able to control their own speed. If your sitskier can't apply sufficient force to their ski edges, then you will need to assist with placing their skis on edge

using your tethers. Snowplows and power snowplows work for slower speeds and beginner slopes. As a tetherer you will find that side slipping will be your safest, easiest and most effective braking strategy.

Use of Terrain in Conjunction with Sitskier's Ability. Use the terrain to the advantage of the sitskier. If the sitskier has trouble turning to one side you can use certain terrain features to assist in making a turn.

11.6 Sitskier Falls

Falling is a part of skiing. There will be falls for both the tetherer and the sitskier. If the tetherer is in a good tethering position falls will normally be up hill and can be best described as a tip-over. Having the sitski high-side, or a fall downhill, will normally be a much more dramatic fall and can result in the sitski rolling.

In the event of the sitskier falling, the tetherer should try to avoid the sitskier, and come to a stop as soon as possible. Remember you are permanently attached. In order to give yourself more time, you can release your grip on the tethers and dump the wraps to give yourself some more space to come to a controlled stop.

Unless the sitskier has an arm trapped beneath the sitski there normally isn't a huge rush to get the sitski upright again. Take some time to assess the situation, make sure the sitskier is okay, then take action to get the sitski back to an upright position.

11.7 Getting up after a fall

11.7.1 Proper technique for righting a sitski

Once it has been determined that everyone is okay, and that no equipment has been damaged, it is time to get back to skiing. The process for sitskiers is very similar to those of skiers and boarders. The first step is to rotate the sitski so that the skis are downhill and aligned across the fall line so that the sitski doesn't start down the slope as you get it back onto the skis. Once the sitski is across the fall line you get it back onto the skis as discussed below for doing it on sloped ground and on flat ground. Make maximum use of your helper and allow the sitskier to assist to the fullest of their abilities. It is always important to assess sitskier fatigue and if required the tetherer may be better to give more assistance to preserve energy levels.

11.7.2 On a slope

This is the easier situation of the two (flat ground and on a slope), just as it is for a stand up skiers. The first step is to make sure the skis are aligned across the fall line with the sitski's head uphill from the skis. If they aren't, get the sitskier to lay flat on the snow which will allow the bucket to spin or pivot on the snow. The tetherer will organize their tethers to get ready to ski once the sitskier is lifted. The tetherer can place one ski above and one below the sitski's skis and hold onto the handle on the back of the bucket. The helper can be downhill of the sitski, to help pull the sitskier upright. Once everyone is ready the tetherer will coordinate the lift so both are working together. Once the sitski is upright the helper continues to hold onto the sitski until directed by the tetherer that they are in control of the sitski. At this time the helper skis away from the sitski and the tetherer can continue down the hill with the sitskier. For a heavier

sitskier the helper may have to place their uphill ski on the sitskis' ski so the edges hold while lifting.

Tip: check to ensure the tethers are clear of the ski edges and angulator and that they have not become tangled in the fall. Never release both tethers at the same time if you need to untangle them.

11.7.3 On Flat Ground

The process is the same on flat ground but it takes a bit more effort to get the sitski upright. If fixed outriggers are attached they become the pivot point for the lift so the sitski has a bit more distance to travel before going to the upright position. This is a bit of an advantage on steeper pitches but a bit of a hindrance on flat ground.

11.7.4 Sitskier Assistance

Whenever possible, it is best to have the sitskier assist with righting themselves after a fall. Falls are a part of skiing. Falling (not crashing) is a part of the learning process as it means we are pushing ourselves and learning new skills. Encourage the athlete to embrace some falls as part of the skiing experience!

Why do we want to have the sitskier assist?

- ✓ It promotes independence. Even if the sitskier requires assistance, they are actively engaged and are having to think and work to right themselves.
- ✓ It provides them some control over the process.
- ✓ It's much easier on the volunteer and tetherer. The sitskier being low to the ground can affect the most leverage for the first 45 degrees when getting up. This is also the hardest part on the back position for the assistant. Conversely, the second 45 degrees is the hardest for the sitskier but is the easiest to manage for the assistant.
- ✓ Promotes and continues teamwork and communication between sitskier and tetherer.
- ✓ Provides sitskier the full experience! If the sitskier is always picked up after falls with little or no effort, they are not getting the full ski experience. Once the habit is formed of doing all the work to right a sitskier, it is difficult to break that habit and teach the sitskier to do it on their own.

What is the process?

1. Have the sitskier assist in rotating the sitski perpendicular to the fall line. The best way for a sitskier to do this is to lie down! By lying down and putting their on-snow shoulder right on the snow, the sitski bucket is on the snow. Sitskis seats, being fiberglass or plastic, are slippery. By having the seat on the snow, they are then able to rotate until their ski(s) are across the fall line. This may be easier on a monoski because they are lighter and the bi-ski articulators can sometimes catch. Note: If the athlete is propping themselves up with their arm and trying to rotate, the ski edges or other parts of the bucket will be catching on the snow making rotating harder.
2. Once the sitskier is across the fall line, have them put their outriggers into the crutch position. Push the outrigger from on-snow side away so that hand is free to push off the

snow. The opposite outrigger should be held firmly in the sitskier's hand and ski positions placed in the corner of a box formed by the sitskier's torso and thighs and the two opposite sides. The outrigger should be placed in the corner farthest from the sitskier's hips, in line with their shoulder and knees.

3. The sitskier will then use their uphill-snow hand to push up as much as possible to set the edge of the ski(s). The tetherer should have their hand on the side assistance strap (nearest the sitskier's hip) – DO NOT PULL – let the sitskier do most of the work. If the tetherer pulls, you will tend to have the sitski slide down to you.
4. Once the ski(s) edge is set, the sitskier should use their opposite arm to set the downhill outrigger to push themselves up to right themselves. At this point the tetherer should be providing some assistance (limit how much based on the strength of the sitskier).
5. Once the sitskier has fully extended their downhill arm with the outrigger, the sitski should be at approximately 45 degrees. The tetherer should then simply HOLD the 45 degree angle and allow the sitskier to pick up their uphill hand and swing their outrigger until they can grab the handle and plant the outrigger in a crutch position.
6. Now that the sitskier has both outriggers on the snow, they can push up with both arms (most of the work will be done by the uphill arm). This is where the tetherer can do more of the lifting. Note: Only lift as much as required to assist the sitskier. Many times the sitskier only needs the help to transition from hand-on-snow to hand-on-outrigger.
7. Once upright, take a few deep breaths and relax. Take a few seconds to relax and reset before heading down the hill. This will allow you as the tetherer to get back into position and will allow the sitskier to refocus on the skills required for skiing.

Tips and Tricks

- ✓ Taking your time and communicating between sitskier and tetherer will lead to the best outcomes.
- ✓ If teaching this technique to a new sitskier, practice this in the morning while the sitskier is fresh. Monitor the sitskier for fatigue and provide more assistance in the afternoon as required.
- ✓ Do a few practice falls (on purpose) on a good intermediate slope. Having a good incline will assist in practicing the steps and provide the best learning environment.
- ✓ Learning how to get up independently can take dozens of practices – it is not just about strength but about timing and coordination – it's ok that it takes time.

12 Tetherer Ski/Board Form

A tetherer's form will be very close to skiing without being attached to a sitski. A good athletic stance, knees bent, and balanced on the centre of the skis. To create a centred position, tetherers may find they need to be slightly more on their heels to offset the pull on the tethers from the sitski and sitskier.

In short: a good/strong tethering ski position = good/strong ski position.

Good tether technique boils down to 6 variables:

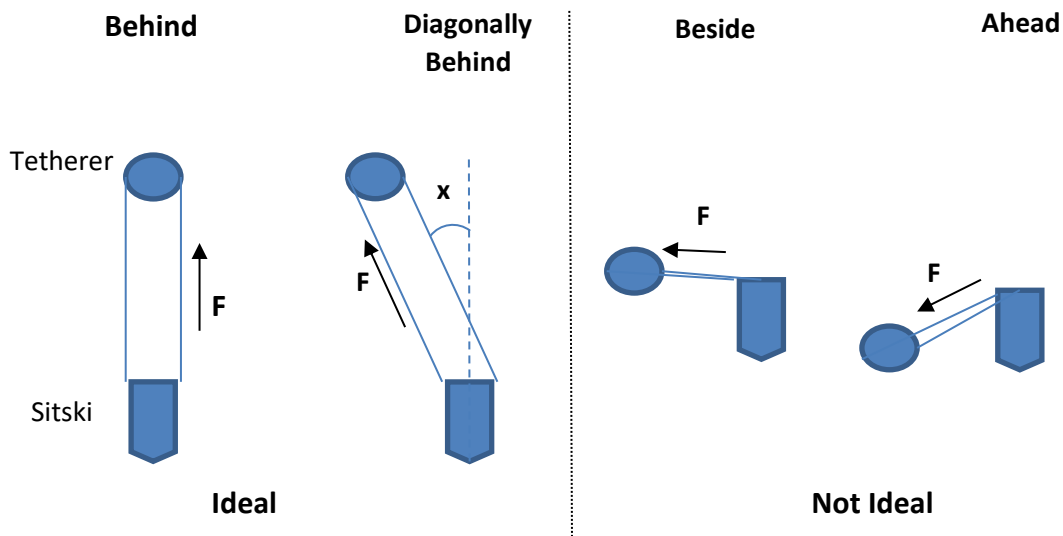
1. Positioning in relation to the sitski (determined by the angle relative to the sitski and length of tether)
2. Tether tension
3. Terrain and snow conditions
4. Turn shape
5. Sitskiers needs
6. The ability to effect emergency stops

All five variables need to be taken into consideration at the same time – some are in coordination with the sitskier and others are about us as tetherer.

You need to work with your sitskier and adjust accordingly to your sitskiers needs, terrain changes and intended turn shape on that terrain

12.1 Positioning in Relation to the Sitski (Angle and Length of Tethers)

There is no single perfect position for tethering behind a sitski as it is more art than science. The tetherer position is directly determined by speed, terrain, snow conditions, turn shape, ability of the sitskier and their needs, etc. Good positioning of the tetherer relative to the sit ski is mostly a function of basic physics but a liberal amount of feel will refine that position. The tethers can only exert a force (F) on the sit ski in the direction they are pulling from:



Ideal:

- ✓ When the tetherer is **Behind** the sit ski they can slow it down/ apply braking forces but only *minimally* affect edging
- ✓ When the tetherer is **Diagonally Behind** the sit ski they can apply braking forces, AND they can pull the ski on edge. The mix between the two is based on the angle x

Not Ideal:

- ✗ When the tetherer is **Beside** the sit ski they can only pull the sitski onto edge (no braking is possible)
- ✗ When the tetherer is **Ahead** of the sit ski the tether will be slack offering no assistance, or if tethers are tensioned, they can acceleration; however, since the tethers are attached at the back of the sit ski, pulling on the tethers will often pivot the sitski and cause a crash

Proper angle relative to the sitski is determined by:

- ✓ The Tetherer should always be on a **diagonal**, uphill or inside of the turn so they can assist with edge control at the various parts of the turn that the skier may need help with.
- ✓ The Tetherer must always be on the uphill or inside of a turn with skis pointed in the same direction as the sitski in the situation that they need to conduct an emergency stop while keeping the sitski upright
- ✓ The degree of angle relative to the sitski is determined by how much assistance is need with either edging or speed control. See diagram above

Length of tethers is achieved through:

- ✓ Proper use of arm and hand movements (e.g. banking or using the steering wheel method)
- ✓ Wrapping and unwrapping of tethers while skiing
- ✓ You should be further away from the sitski when moving more quickly
- ✓ You should be closer when going slow

Proper use of arm and hand movements (banking / steering wheel method):

- ✓ Elbows should be near your side/trunk, and bent
- ✓ Ideally the uphill (inside) tether will be lower than the downhill (outside) tether. Think of turning a big steering wheel to the right: the left hand is higher than the right hand. In this way, your hands are “banking” and mimicking the desired edge you want to set on the sitski
- ✓ Keep shoulders, elbows and wrists relaxed and flexible – this creates a natural shock absorption system and will create more consistent tether tension and thus a smoother ride for the skier

- ✓ If you can detect that the sitskier needs help quickly and correct that with the right tension early, a small pull from your wrist maybe sufficient. If you don't, then in a second, you will have to make a correction from the elbow, and if still not, then you have to make a big motion with your whole arm and may not correct it in time

Things to avoid:

- × Skiing directly behind the sitski and close enough so the tetherer can grab the ski is basically thumbing (means you are skiing directly behind the sitski at all times). This is counterproductive to learning proper technique and detracts from the learning experience for the sitskier. It can also pose safety risks. If the sitskier falls there is no distance for you as the tetherer to stop safely before impacting the sitskier.
- × Hands should not be raised over your shoulders
- × Ahead of the sitskier is never good. If you are caught in this position let the tethers go slack and slow down until you are diagonally behind the skier. From this position you cannot help your sitskier what so ever with speed or edge control.

Wrapping and unwrapping is the process of either shortening (wrapping) or lengthening (unwrapping) the tethers in a manner that retains consistent tension on both tethers throughout the process. This process allows the tetherer to change their distance between themselves and the sitskier smoothly without effecting how you are helping the sitskier. Wrapping places loops of the tether around your hand(s) by rolling your wrists around and gathering the tether(s). To unwrap, you slightly relax your hand and use your thumb to control the speed and tension of unwrapping, ideally one wrap at a time. Practice this while not in motion so that it become second nature and you can concentrate on proper tension, rather than length of tethers.

When you are wrapping and unwrapping it is best to keep the length of the tethers the same. Meaning you wrap and unwrap both your left and right hands at the same time.

Remember, as speeds increase, and terrain steepens, it's advantageous to lengthen the tethers. One reason is for safety, if things don't go as planned, it's better to be further away, gives you more time to react and avoid a collision with the bucket, another reason is that it gives you positioning more margin for error, you are half as likely to change the angle of pull if your tethers are twice as long.

12.2 Tether Tension

With the exceptions of using a single tether or assisting a semi-independent sitskier, there will always be varying degrees of tension in both tethers. Tether tension assists in the objective of controlling the turn of the sitski by putting the ski(s) on their edge with the skis pointed in the direction you would like it to travel. In principle, tether tension assists in tilting the sitski. This is no different than a stand-up skier who uses their lower body to get the skis on edge which will make the skis turn. Simple to talk about but takes a bit of practice. If the tether tension is increased, it will pull the sitski towards the tetherer and if the tethers go slack the sitski will tend to go to the fall line. Neither result is ideal as it alters the direction of the sitski from sitskier's

intended line choice. Depending on the sitskier, the sitski, type of outriggers, and terrain, you will need different amounts of tension to make the sitski do different things.

Changing tension. You'll need to change the tension that you impart on the sitski to suit the situation. To make a turn, as you are completing a turn, there needs to be a decrease in tension, coordinated with the tetherer moving behind the sitski, in order to allow the skis to flatten and point down the fall line, and as the tether moves to the inside of the next turn and begins to increase tether tension again, sets and holds the edge. All the while understanding that:

Too much tension – you will eventually come to a stop.

Not enough tension –the sitski will not respond and go somewhere that you don't want it to go.

Inconsistent (on/off) tension – creates instability for the sitskier often leading to wobbles and/or falls.

Abrupt changes in tether tension should be avoided as it creates a very harsh and jerky ride for the sitskier, **it is always best to progressively build or release tension.**

Use of the uphill and downhill (or inside/outside) tether varies slightly depending on the type of sitski you are tethering:

Quadski

The maximum edging available to the sitski is limited by the fixed outriggers. Therefore, too much tension (short of pulling it over the fixed outrigger) isn't really an issue because the pontoon will limit how far you can pull the sitski over.

Tension on the tethers can be equal or either inside or outside tether can be used to set the edge for the sitski. Using the outside tether (i.e. downhill) provides a significant leverage advantage for quadskis and can be advantageous on steeper slopes or in bumpier snow conditions.

Biski or Monoski

With a sitskier using handheld outriggers, too much tension will tend to pull them off balance and more than likely make them fall up hill. Not enough tension will mean faster speed and not enough assistance turning. Thus, a lot more finesse is required.

The inside (uphill) tether must be the control tether and do 70% of the work to set and maintain the edge. This is critical to the success of athletes using the biski or monoski. By using the inside (uphill) tether as the primary mechanism to assist the athlete with the turn, it will encourage the use of their hip to control the edge of the ski. Alternatively, if you favour the outside (downhill) tether to assist with edge control, this can cause the ski to pivot around the downhill tether attachment point, causing the sit ski to rotate towards the fall line, counter to what they are intending to do. Or the backend will flat ski fishtail which leads to a very uncomfortable and unstable ride for a sitskier using handheld outriggers.

Advanced progression/tips. Use of index fingers for fine adjustments (crooking finger under the tether) and cocked wrists to finesse the tension is a learned technique and is best practiced on flat ground to avoid the sitski from rocking back and forth on the fixed outriggers. With fingertip tethering the bounce back can be avoided but once the bouncing starts the sitski must be

turned onto one outrigger or apply braking. Also varying how much tension is on the individual tethers and be used to aid more advanced sitskiers. By pulling on the inside tether slightly more than the outside you can encourage more angulation at the hips from your sitskier, and with more tension the downhill tether, you have more leverage over a heavy sitskier in order to pull their ski in to a turn.

12.3 Terrain and Snow Conditions

The type of terrain and snow will impact how you tether. Steeper, more varied terrain will require longer tethers and often more acute tethering angles to affect the edge of the sitski. As terrain mellows, if the sitskier has difficulty balancing you may need to shorten the tethers and your position relative to the sitski will be more from behind; reducing tension as well to reduce braking forces in order to maintain speed.

Aside from the selection of green, blue or black runs impacting the type of terrain to be skied, rolls and dips, off-axis fall lines, hazards such as rocks, and width of the runs all affect how we will tether. Rolls and dips usually mean the sitski will speed up or slow down *before* the tether reaches the same change in terrain. This means as a tetherer, you must proactively change position, tether length, or your speed relative to the sitski in order to maintain a consistent tether tension. Off-axis fall lines one turn will be longer than the other impacting timing. Hazards and obstacles in run will mean changes to planned turns in order to avoid them.

Not only will snow conditions vary from day to day but often change hourly. Runs that start off as perfectly groomed in the morning can become “skied out” and have icy patches between clumps of snow. Tethering in deep snow is different than no snow. Spring snow conditions where the snow is very wet and boggy poses different challenges than light powder. While there are too many combinations to document and describe, consider the following:

- ✓ Consistent groomed runs that allow the edges to bite into the snow allows for a smooth, uniform turn and speed
- ✓ Patches of ice can cause skidding or sliding if the skis are not edge and balance centred
- ✓ Running into deeper piles of snow will slow the sitski down
- ✓ Skiing through deep snow will be slower than skiing the same run on a groomer day
- ✓ Moguls or ‘snow clouds’ can throw the sitski off edge unless adequate tether tension is maintained
- ✓ Sitskis are much slower in wet, heavy snow than on groomed runs or in lighter snow
- ✓ Outriggers, whether fixed or handheld, can catch in deeper snow and will cause the sitski to rotate very quickly

While groomed runs may be the easiest and most consistent snow conditions for tethering, skiing is about enjoying all that the outdoors has to offer throughout the season! Enjoy practicing in all the different conditions. Encourage the sitskier and share the passion of being outside.

12.4 Turn Shape

Turn shape directly impacts your position relative to the sitski. Short radius turns means you will be more behind the sitski. Long sweeping GS type turns will require you to tether with a greater angle to the uphill (inside) of the turn.

Linked turns have a different rhythm than turns with long traverses between them.

As with any skiing, turn shape is dictated by a combination of snow conditions, terrain, obstacles, patrons (i.e. other skiers and boarders), desired speed, and just plain old, “I feel like doing this!” When tethering, mix it up! There is no need to repeat the same path and turns every single run!

12.5 Sitskiers Needs

All skiers participating in the program have different needs. The sitskiers need to be considered against four factors:

1. **Ability Level.** Beginner sitskiers will need assistance with speed control, braking and turning, where an intermediate sitskier may only need some assistance turning, and more braking. Advanced sitskiers should not need help turning, just braking, until they learn to control their speed by using the turn shape and terrain. Remember that as the sitskier practices throughout the season, their skills will change. This can be particularly important to remember if you haven’t skied with the sitskier for several weeks.
2. **Environmental conditions.** Weather (clear, cloudy, snowing, raining), snow conditions, temperature, and time of day (i.e. light conditions) will affect what assistance the sitskier will need.
3. **Personality and past experiences** will impact confidence, likes and dislikes, willingness to try new things, and how you they will ski
4. **Physical conditions** such as fatigue, previous night sleep, mood, did they eat breakfast/lunch, and level of concentration, etc. can all affect how they will ski and what type of assistance they require

12.6 The Ability to Effect Emergency Stops

You must always be in position to effectively perform an emergency stop. **Emergency stops must be completed using a hockey stop** (skis) or an **aggressive heel side brake** (snowboard). These provide the most braking power possible and will stop you and the sitskier in the shortest distance possible.

Never assume that your sitskier will do what as required (i.e. try to avoid an obstacle or another patron). Be sure there is good communication with them at all times. Either you are calling turns, (left, left keep going left, ok now right) , line choices, (make a left and make a turn below the lift tower), and providing a heads up about their surroundings, (snowboarder coming past on your right side) – or they are communicating their intent to you.

Consider the following:

- ✓ If you are not sure you are going to avoid obstacle, danger or patron – STOP IMMEDIATELY and as quickly as possible!
- ✓ Faster the speed, the more effort is required to stop. Performing controlled stops *before* a reaching a speed where emergency stops become very difficult allows you and the sitskier to reset and be in safe, fun, learning environment

- ✓ The best emergency stop is the one that never happens! Be as proactive as possible to manage speed, plan the route, avoid congestion (or wait for it to dissipate), communicate early and often.

12.7 Calling Turns

Like everything involved in tethering, communication is another variable that gets worked out with a team but there are some tips which can be used:

- ✓ With a quadskier it is best for the tetherer to call the turns when they initiate by lessening the tension on the tethers. With a newer tetherer it is best to call all turns to ensure the tetherer is in the correct position to control the turn as necessary and the sitski doesn't take off in an unanticipated direction.
- ✓ As a team gets more comfortable skiing together it becomes easier to anticipate each other's movements and anticipate what will come next. It is possible to ski without calling turns by the sitskier feeling a bit of the tether control and reacting to that. For example the lessening of tether tension will signal a turn. When the sitskier is able they can determine the path they want to take and small things like head movements, leans, outrigger reaches/turns will all give great clues as to what is going to happen next and can be anticipated. It should be noted that many quadskiers can initiate and hold their turns if given the opportunity.
- ✓ Advanced and Expert tetherers should ensure that athletes are doing their utmost to control their own skiing rather than have the tetherer control and call every turn or stop.

12.8 Pairing Sitskiers with Tetherers

Program Coordinators will be responsible for pairing sitskiers and tetherer. They have a baseline understanding of the sitskiers needs and the tetherer capabilities. Baselines change as the season progresses, **so at any time, if you as the tetherer do not feel comfortable with the matchup, it is imperative to find your Program Coordinator or an instructor and discuss options.**

12.9 Different Tether Techniques

The fundamentals of tethering safely and effectively are consistent and relatively structured – position relative to sitski, tether tension, length of tethers, ability to stop.

Experienced tethers and instructors have developed tricks and tips that evolve into personal styles. Examples include but are not limited to:

- ✓ Some tethers will snowplow 99% of the time, others will sideslip whenever possible
- ✓ Attaching the tethers at the wrist vs. on the forearm
- ✓ Anchoring the uphill (inside) tether hand against the thigh for support and leverage vs. not
- ✓ Strategies for wrapping and unwrapping

However in these examples, all tethers do:

- ✓ Emergency stops using hockey stops
- ✓ Use a girth hitch to attach the tethers
- ✓ Employ a strategy to tension the inside/outside tethers differently and effect the correct ski edge angle
- ✓ Shorten or lengthen the tethers so they have constant tension and the tetherer can adjust their distance from the sitski appropriately

Most programs will have many tetherer and tetherer instructors. Slight differences in approaches and styles will allow you to adopt the variations that work for you.

13 Choosing the Correct Skis and Bindings for the Sitskis

The ski(s) used on the sitski can change the performance dramatically.

The first choice is whether you need one ski for a mono or two skis for a biski. Never use a single ski from a pair designated for biskis on a mono. Mono skis put different stresses on skis than a biski and consequently you do not want to create any unbalance between pairs of skis for the next skier in a biski.

However, before describing which skis are best for the different sitski applications it is important to understand ski technology and the terminology used to describe skis. Refer to Appendix B for more information.

13.1 High DIN Bindings

Not all bindings are created equal! The correct bindings must be used for sitskis.

13.1.1 Force Release Settings (DIN)

Release Force Setting (DIN), short for Deutsches Institut für Normung (German Institute for Standardization), is the industry-adopted scale of release force settings for ski bindings.

The DIN setting is calculated based on your boot sole length, age, weight, height and ability level, when your bindings are mounted on your skis. The higher the DIN, the higher the force required to release from your bindings.

All sitskis should use the sitskis manufacturer customized bindings or a suitable high DIN Binding (17 DIN or better, preferably 20+). Even junior sitskiers should have the high DIN bindings used and cranked to maximum. Unlike stand-up skiers where you want the binding to release (save knees and ankles), sitskiers NEVER want the ski to separate from the sitski.

13.1.2 Ideal Sitski Bindings

The best bindings for sitskis that employ a boot-like interface have metal toes and heel pieces and are generally bindings meant for adult racers. Some of the more popular models include:

- ✓ Salomon S918
- ✓ Salomon S920
- ✓ Marker Comp 20-Din and Comp 30-Din
- ✓ Fischer 17Din
- ✓ Atomic X20 RS (favourite for sitskiers)

These bindings are not cheap. They tend cost twice or three times the amount of recreational, plastic bindings. Do not cheap out – recreational use bindings, even if pinned, will not survive the rigours of sitskiing and pose a safety risk.

It should also be noted that none of these bindings use a “rail” system to mount to a ski. They require a flat top. They can interface with their own brand of ski (e.g. Atomic X20s mount on the race skis) but because they only require a flat top, they can work on any brand of that has a clean top surface (i.e. no manufacturer specific mounting system).

The Atomic X20 RS can be considered the best sitski binding on the market today. It features a full metal construction, DIN 12 to 20, is a full flex binding and is designed for heavier racers (175+ lbs) meaning it can take a beating and still deliver. But what sets the Atomic binding apart from all other high-DIN bindings is its ability to adjust the binding fore/aft by almost 5 cm (2"). This means that if the sitski does not have a centre of mass adjustment, or the ski requires a slight variation from other skis the sitskier is using, the binding can be mounted to manufacturer suggested boot centre and then tweaked either fore or aft to create the best balance point.



13.1.3 Mounting Sitski Bindings

Whenever mounting bindings onto a ski meant for sitskis, be sure to inform your ski technician of this fact. The forces on the binding and ski caused by a sitski are more substantial than most stand up skiers. It is a good idea to have the bindings screws sealed with wood glue or Loctite (medium) to ensure vibrations and force do not loosen them over time.

The bindings should be set properly for the sitskis boot size, but unlike skis meant for stand-up skiers, the forward pressure can be maxed.

Many of the sitskis today have the capability of changing the centre of mass (CoM) of the sitski frame over the boot. This means that the binding should be mounted to the ski manufacturers recommended boot centre mark. This is the ideal position for the ski to perform at its best.

It should be noted that some skis (for example the Prashberger Monoski) do not have a CoM adjustment. If the program or sitskier cannot use an adjustable binding such as the Atomic X20 RS, mounting the binding in the correct place to find the perfect CoM is a trial-and-error affair.

A good way to start is to mark the centre of the sitski's boot. Have the sitskier perform a dowel test on the sitski boot (no ski attached) – be careful as this can be difficult and the athlete may require assistance balancing. Note the balanced position relative to the boot-centre mark and use this to adjust where to mount the binding(s) on the ski(s). Many sitskis such as the Prashberger monoski requires the binding to be moved ½" forward of boot centre.

13.1.4 Ski Storage

It is generally not a good idea to keep high-DIN bindings mounted to the sitski all the time (e.g. when in storage or overnight). Bindings rely on springs to operate. Keeping the springs in the locked and loaded position for months on end is a sure way to wear the binding prematurely.

13.1.5 Pinning and Slugging the Bindings

It is possible to modify the bindings to prevent releases. This should be done with caution. Although sitskiers' do not want their skis to release, breaking skis instead of releasing can be very expensive and troublesome. Many advanced skiers will only pin or slug their bindings for races or other special events, but for general skiing leave it unpinned.

SLUGGED: Refers to replacing the front spring with a slug or tube of stainless steel. This will prevent the front from releasing side-to-side or diagonally. Many sitskiers' will slug all their ski bindings.

Be sure to clearly mark all bindings that have been slugged. A stand-up skier should NEVER use a binding that does not have a releasable toe or heel piece.

PINNED: Refers to a mechanism to prevent the rear heel piece from releasing. There are several ways ranging from plastic blocks to bolts through the binding. These devices are generally added after the sitski has been clipped into the binding.

13.2 Quadski Ski Selection

Almost exclusively will use asymmetrical, extreme short radius skis.

The traits that make these skis so attractive for the quadski setup include:

- ✓ Wide waist improves stability and balance when at rest
- ✓ Ideal for slow to medium speeds on hard packed, groomed runs and on-piste runs
- ✓ Aggressive, short turning radius allows for easy turns and high edge grip, particularly when assisted by a tetherer
- ✓ Are shorter and designed for quadski setups, helping to prevent interference with the angulator mechanisms
- ✓

There are a few cases different skis may be effective:

- ✓ Deep snow – switching to a wider, but still short radius ski. Must be careful to ensure that the full range motion for the angulator can be achieved
- ✓ Higher speeds – the asymmetrical, extreme short radius skis can be unstable for higher speeds. In this case, moving to a short radius ski can benefit the sitskier and tetherer

13.3 Biski Ski Selection

As with all skiers, selecting the best skis for a biski sitskier should be done based on skill level, weight, and snow condition (i.e. most common) with one addition – type of sitski being used.

13.3.1 Beginner

Beginner traits most typically include:

- ✓ Using hard-packed or groomed beginner and easy intermediate runs
- ✓ Learning to balance, initiate and hold turns
- ✓ Continuing to practice stopping in a controlled and consistent manner
- ✓ Often requires tethering or single tether (for safety)
- ✓ Initiation and acquisition mode of skills
- ✓ Slower speeds and many stops
- ✓ Limited situational awareness (focused more on their own skill development than what is going on around them)

Mountain Man, Bi-Unique, Dynamique, and HOC Glide

These sitskis are ideal setups for the asymmetrical, extreme short radius skis. They provide a greater based of support for learning balance and the extreme short radius skis encourage turning with minimal effort, which assists in balance and coordination and the overall consolidation of skills.

Tessier Dual Ski and Scarver

Use short radius skis in the all mountain category (i.e. wider underfoot – around 80 mm). Keep the skis shorter (approx. 150cm for children and 155-165cm for adults depending on weight). Softer skis that have a beginner to intermediate flex are best. While it would be ideal to have skis that are torsionally stiff (don't twist), it is more important that the skis can bend and carve at slower speeds while the sitskier is learning to ski. It is best to use cambered skis and skis with sidewalls will tend to last longer, though capped skis are still suitable.

While it is possible to mount high-DIN bindings on the asymmetrical, extreme short radius skis, this is rarely done and of limited value for the sitskiers using these more advanced biski models.

13.3.2 Intermediate

Intermediate traits most typically include:

- ✓ Using hard-packed or groomed beginner and intermediate runs
- ✓ Acquisition and Consolidation phases of skill development including stopping, balance, timing, coordination, and situational awareness
- ✓ Often requires tethering or single tether (for safety)
- ✓ Slow to medium speeds

Mountain Man, Bi-Unique, Dynamique, and HOC Glide

Continued use of the asymmetrical, extreme short radius skis is still a very suitable choice.

For the sitskiers that are starting to increase their speed, moving onto ski runs that offer deeper snow or are less-groomed, and are progressing to semi-independent or independent sitskiing, the use short radius, carving or all mountain skis are recommended. Softer skis that have an intermediate flex are best. While it would be ideal to have skis that are torsionally stiff (don't twist), it is more important that the skis can bend and carve at slower speeds. Keep the skis shorter (approx. 150cm for children and 155-165cm for adults depending on weight).

Tessier Dual Ski and Scarver

Same selection as Beginners.

Use short radius skis in the all mountain category (i.e. wider underfoot – around 80 mm). Keep the skis shorter (approx. 150cm for children and 155-165cm for adults depending on weight). Softer skis that have a beginner to intermediate flex are best. While it would be ideal to have skis that are torsionally stiff (don't twist), it is more important that the skis can bend and carve at slower speeds while the sitskier is learning to ski.

13.3.3 Advanced

Advanced traits most typically include:

- ✓ Primarily in the consolidation of skills phase
- ✓ Using hard-packed or groomed runs throughout the resort (i.e. green, blue and black runs)
- ✓ Looks for and/or is capable of skiing off-piste and more challenging snow conditions
- ✓ Most often is independent or semi-independent (single tether for safety)
- ✓ Faster skier
- ✓ May be looking for jumps, bumps and/or use of the terrain parks
- ✓ Sitskiers will be moving away from the beginner to intermediate style sitskis

While continued use of the intermediate skis is possible, these sitskiers will find that the shorter ski length and softer flex may cause stability issues at higher speeds. Additionally, if they are looking to use the terrain parks and other features, the softer construction of beginner and intermediate skis not ideal. Therefore the ideal skis should be:

- ✓ Slightly longer (160-175cm for adults) depending on weight and ski style
- ✓ Skis with are sidewall constructor or hybrid (Sidewalls underfoot) are recommended
- ✓ Stiffer flex is important to assist with stability at higher speeds
- ✓ Skis with improved torsional stiffness will greatly assist the skier in turning and improve stability at speed – although on the biskis, this is less critical than on monoskis for advanced skiers
- ✓ Unless the sitskier is primarily in deeper snow conditions, off-piste, or bowls where a rocker ski (or rocker ski hybrid) will assist in flow, it is suggested that cambered skis still be used
- ✓ Consider moving to race/carving skis, all mountain skis, or twin tips depending on the slopes and types of terrain most often used

13.4 Monoski Ski Selection

General conventions:

- ✓ Never use an asymmetrical ski on a mono ski
- ✓ Always use high-DIN bindings
- ✓ Don't use a ski designated for continued use on biskis on a monoski

- ✓ Torsionally stiff skis are increasingly important for monoskis
- ✓ Skis used on monoskis tend to breakdown/fatigue faster – full weight on a single ski for every turn

13.4.1 Beginner

Beginner traits most typically include:

- ✓ Using hard-packed or groomed beginner and easy intermediate runs
- ✓ Learning to balance, initiate and hold turns
- ✓ Continuing to practice stopping in a controlled and consistent manner
- ✓ Often requires tethering or single tether (for safety) but may also be independent from the start
- ✓ Initiation and acquisition mode of skills
- ✓ Slower speeds and many stops
- ✓ Limited situational awareness (focused more on their own skill development than what is going on around them)

Ideally use short radius ski in the all carver or mountain categories. Underfoot between 70mm and 85mm is ideal. Going wider may promote balance on flats and while stopped, will make it much more difficult for the sitskier to edge and learn to turn the ski.

Keep the ski shorter (approx. 150-155 cm for children and 150-170 cm for adults) depending on weight). Softer skis that have a beginner to intermediate flex are best. While it would be ideal to have skis that are torsionally stiff (don't twist), it is more important that the skis can bend and carve at slower speeds while the sitskier is learning to ski. It is best to use cambered skis and skis with sidewalls will tend to last longer, though capped skis are still suitable for beginner monoskiers.

13.4.2 Intermediate

Intermediate traits most typically include:

- ✓ Using hard-packed or groomed beginner and intermediate runs
- ✓ Acquisition and Consolidation phases of skill development including stopping, balance, timing, coordination, and situational awareness
- ✓ Most often is independent or semi-independent (uses a single tether for safety)
- ✓ Slow to medium speeds

Same ski selection as beginners is not suggested. The softer, shorter skis will be less stable for intermediate skiers on progressively more challenging runs and snow conditions.

Best practices include:

- ✓ Keep the ski shorter (approx. 150-155 cm for children and 150-170 cm for adults) depending on weight)
- ✓ Increased flex (longitudinal) stiffness is important
- ✓ Skis that exhibit little (to no) torsional twisting is increasingly important for stability and edge control while turning

- ✓ Skis with wood cores or higher-end laminates innards will significantly increase longevity of the ski and improve safety (i.e. less likely for bindings to pull out of the ski)
- ✓ Continue to use cambered skis unless the sitskier is primarily in off-piste and deeper snow conditions
- ✓ Carving, all mountain, and twin tip skis are all suitable choices – suggested to keep the underfoot less than 90mm unless in very deep snow regularly

13.4.3 Advanced

Advanced traits most typically include:

- ✓ Primarily in the consolidation of skills phase
- ✓ Using hard-packed or groomed runs throughout the resort (i.e. green, blue and black runs)
- ✓ Looks for and/or is capable of skiing off-piste and more challenging snow conditions
- ✓ Faster, independent skier
- ✓ May be looking for jumps, bumps and/or use of the terrain parks
- ✓ Sitskiers will be moving away from the beginner to intermediate style monoskis and into advanced or race sitskis

Any type of ski based on the terrain being skied. There are a few principles to be considered:

- ✓ Ski are generally 5-10cm longer than height/weight of the sitskier would normally dictate if using 2 skis. e.g. if the sitskier is 5'10" and 180 pounds, consider a 175cm ski instead of 167-170 cm. Accounts for the additional weight of the sitski and use of a single running surface.
- ✓ Cambered skis are most suitable if primarily skiing on-piste
- ✓ Rocker skis and hybrids make great power and off-piste skis for sitskiers but can be more challenging on-piste (particularly groomed runs)
- ✓ For deeper snow conditions, longer, wider skis than if using 2 skis is suggested. Again consider 5-10cm longer than an equivalent "two skier" and a few millimetres more underfoot to account for a single running surface. E.g. 185cm/105mm or even 185cm/110mm are excellent powder/off-piste skis.
- ✓ Capped skis are never recommended – stick with the sidewall technology
- ✓ Stiffer flex with little (or no) torsional twist is very important
- ✓ Wood core skis using advanced materials such as titanium, metal, carbon fiber inlays are ideal

13.5 Tidbits of Ski Selection

Used race skis can make great sitski skis under the right conditions because they are almost always very torsionally stiff and have wood cores and advanced laminates.

When brand new, race skis are very stiff (longitudinally) and not suitable for anybody except the most advanced sitskier. They are like skiing on 2x4s because the skis don't bend when the sitskier puts them on edge.

However, when used, and broken in, the racers will soften the skis significantly and over time the longitudinal flex is reduced. Racers retire these skis as they no longer hold an edge at their faster, more aggressive speeds. Picking these skis up for sitskiers can be really beneficial – the torsional stiffness is ideal for any sitskier, particularly for monoskiers. The longitudinal flex can be matched to the appropriate sitskier. For example, if a race ski is acquired and it is still relatively stiff it can be used for an advanced or intermediate skier. As the flex continues to soften, it becomes more appropriate for beginner skiers. The torsional stiffness is always the last to go on a pair of skis. “Hand me down” race skis should be acquired whenever possible.

14 Advanced Discussions

14.1 General Sitski Technique

Every skier will have different needs, strengths, weaknesses and capabilities. It is our job as tetherers to work with our skiers strengths, and use them in ways to instil confidence and fun that will in turn promote skill development to allow the sitskier to enjoy this amazing winter pastime that we are all so passionate about!

Busting the myth: It is not harder for a sitskier to learn how to ski; nor is it radically different from stand-up skiing.

With the amazing developments in the biski and monoski equipment, sitskiing, like any stand-up skiing, whether 2-track, 3-track or 4-track is about getting the skis to edge, maintaining balance, and remaining in control as the athlete moves down the slope. As with any athlete, a sitskier's previous experiences, athletic endeavours, physical literacy, and confidence will influence how the sitskier progresses.

This section summarizes the sitskier's skills as found in the CADS Instructor Manual, Chapter 9.4 Sitskis. Refer to the manual for detailed skill development and AOT guidelines.

1. The sitskier starts off in a neutral position; body straight, weight centered both side-to-side, and fore and aft. This neutral position allows the skis to be flat.
2. To initiate a turn, the sitskier will first **look** where they want to go, then progressively **weight** the front of the skis while creating an **edge** in the direction they wish to travel. Sitskiers with handheld outriggers will move their inside outrigger forward and out, almost pointing to where they will turn (their other outrigger should still be positioned near their feet). The actions of looking where they want to go, leaning forward, and pointing with their inside outrigger will allow the sitskier to get on edge thereby allow the ski(s) to turn.
3. Once the sitskier has completed their turn, they need to come back to the neutral position (flatten the skis) in order to transition to the next turn. To make this happen, the sitskier sits up, pulls their outriggers in, nearer their body. The ski(s) will flatten, allowing the sitskier to the initiate the next turn by looking, weighting and pointing in the opposite direction.

As a tetherer, you can assist in the steps above by:

1. Slackening tether tension (not off, but not fully on)
2. Allowing the sitskier to start turning (falling) towards the fall line
3. Moving yourself to the other side (timed to the turn of the sitski)
4. Positioning yourself and adjusting tension throughout the sequence
5. Adding tension as required to help the sitskier set their edge or provide braking action

In short: Reduce tension, turn, position, increase tension if required, repeat in the other direction

What about sitskiers without handheld outriggers? Exactly the same! They start in a neutral position, sitting upright and centred (side-to-side and fore/aft). Once in motion, the sitskier will **look** where they want to go, progressively **lean** forward, and **point** with one (or two hands) in the

direction of travel they wish to go. The skis will be on edge and the sitski will turn! Once the turn is complete, the quadski will need to return to neutral to allow for a transition to the next turn. The sitskier can effect this transition by leaning back to centre their weight and bringing their hands back to their body. Now that they are back in their neutral position, they initiate the next turn and continue to link turns down the hill!

14.2 Single Tethers

Once a sitskier is nearing independence or is able to control their turning and speed it may be time to permit them the next level of independence and permit them to be tethered by a single tether.

The theory behind a single tether is that the tetherer goes from being responsible for assisting in turning and speed control to just speed control, and emergency brake. For this reason the tetherer spends most of their time almost directly behind the sitskier and tries not to affect balance by only pulling directly back on the tether. The one issue is if the sitskier does a quick turn it gets amplified to the tetherer and causes a crack the whip effect and could be severe enough to take the tetherer off their skis. There may be an argument to not strap the tether to the tetherer's wrist in this particular situation but the risk is that the tetherer is there because the sitskier needs assistance with speed control and the loss of the tetherer could create an unsafe situation. One way to mitigate these risks is to use a longer tether with more wraps still girth hitched around the wrist. This gives the tether the slack they need to either get back on track behind the sitskier or to just dump their wraps if a whip is about to occur.

15 Appendix A: Detailed Course Outline

15.1 Day 1 (6 hours, 15 minutes course time. Total duration of 7 hours, 30 minutes)

Topic	Location	Duration
Introduction & Aim of the Course	Classroom	15 min
Role of a Tetherer	Classroom	15 min
Overview of Tetherer Skill Levels and Core Competencies	Classroom	15 min
Safety Discussions	Classroom	30 min
Bio break & Boots on		15 min
Skiing & Boarding Skills Assessment (Drills 1 – 7)	On Hill	105 min
Lunch		45 min
Understanding the Sitski * bring a sitski up (allows people to finish lunch) + Boots On	Classroom	30 min
A Run from the Top of the Hill & warm-up run after lunch	On Hill	30 min
Skiing & Boarding Skills Assessment (Drills 8 – 10)	On Hill	60 min
Bio break		15 min
Loading and Unloading a Sitski	On Hill	15 min
Weighted Quadski Tethering Progression (1/3)	On Hill	60 min

Day 2 (6 hours, 15 minutes course time. Total duration 7 hours, 30 minutes)

Topic	Location	Duration
Review of Tetherer Ski Form & Blocker Duties	Classroom	30 min
Fitting an Athlete in a sitski	Equipment Room	30 min
Bio break and Boots On		15 min
Weighted Quadski Tethering Progression (2/3) Practice to demonstrate Competency	On Hill	120 min
Lunch		45 min
General Discussion (equipment, position, safety, etc.) * bring a sitski up (allows people to finish lunch)	Classroom	15 min
Bio Break and Boots On		15 min
Weighted Quadski Tethering Progression (3/3) Practice to demonstrate Competency	On Hill	150 min
Course Wrap up and feedback	Classroom	30 min

Practice sessions

Topic	Location	Duration
Advanced tethering skills; Progression to more advanced tetherer certifications	On Hill	Practice to demonstrate Competency

Future Course (Advanced Tethering Clinics)

Topic	Duration
How to Assess Athletes & Choose an Appropriate Sitskis	2 hours
How to Choose Appropriate Skis for the Sitski	1 hour
Advanced Athlete Fitting for Sitskis	2 hours
Advanced Tethering Clinics	Practice based


16 Appendix B: Sitski Models


The following section describes various models of sitskis. It is divided into Biskis (those with 2 skis underneath) and monoskis (single skis).


Every attempt to ensure the accuracy and reliability of the information provided in this section has been made. However, the information is provided "as is" without warranty of any kind. The authors do not accept any responsibility or liability for the accuracy, content, completeness, legality, or reliability of the information contained in this section.


Name	Manufacturer and model name of the sitski
Picture	Picture that shows the frame of the sitski
Skier Profile	Describe the type of skier (beginner to advanced), suitability for differing levels of disability/injury and suitability for programs
Seat Type	Type of seat. Whether dump can be adjusted. Seat sizes (if available)
Shock	Type of shock and adjustability options. Original manufacturer's models have been listed but it should be noted that used sitskis may have different shocks mounted.
Fixed Load?	No: sitski frame "opens" to assist in load. Yes: sitski frame does not open to assist with getting onto a chairlift
Load Assist?	No: No mechanical assistance provided – athlete must use outriggers to manually lift into position for the chairlift. Yes: mechanical assistance is available and most often described (e.g. hydraulic shocks)
Binding	Type of binding required
Maintenance	Rating out of 10 for ease of maintenance and durability of the equipment. May be considered subjective but is based on many years experience and many technical manager's input
Ski(s)	Type of ski(s) that may be fitted and used on the sitski
Quad Setup?	For biskis only. Can the sitski be fitted for a quadski setup? If yes, describes the options.
Surface Lift?	Does the ski have the capability for surface lifts?
Additional Information	Misc. information gathered and presented


Current Biski Reference Chart


Biski	Picture	Skier Profile	Additional Information	
<p>Enabling Technologies Bi-Unique</p>		<p>Extremely low centre of gravity (Lowest in industry) Entry level program ski Beginner level of sitskiers</p>	<p>Seat Type</p>	<p>Fixed, high back. Very high dump. Cannot adjust dump. Seat sizes (S: 10-13" with cut down thigh, M: 11-15" and L: 13-15")</p>
			<p>Shock</p>	<p>No suspension</p>
			<p>Fixed Load?</p>	<p>No</p>
			<p>Load Assist?</p>	<p>Yes, hydraulic jack.</p>
			<p>Binding</p>	<p>Custom bindings. Can remove skis from sitski.</p>
			<p>Maintenance</p>	<p>10/10</p>
			<p>Ski(s)</p>	<p>Extreme short radius, asymmetrical skis only (i.e. "Banana" Skis)</p>
			<p>Quad Setup?</p>	<p>Fixed outriggers available T-handle bar for sitskier available</p>
			<p>Surface Lift?</p>	<p>Not from manufacturer but can be retrofitted</p>
<p>Additional Information</p>	<p>Rear handle bar is not removable; cannot be adjusted for height Hydraulic jack position makes it difficult for sitskier to access independently.</p>			


Enabling Technologies Dynamique		<p>Great program ski</p> <p>One frame size fits skiers from 4'1" to 6'3"</p> <p>Shock spring rate should be approx. twice the skiers weight (available in 300 lbs., 400 lbs. and 500 lbs. springs)</p> <p>Beginner to intermediate level of skiers that require lower centre of balance and bi-skis for stability</p> <p>Locking load position but many skiers find it difficult for skier to get to the locked position independently</p> <p>Locked loading position creates an awkward position for independent skiers to move up to and around the lift (most often requires assistance from instructor or tetherer)</p>	Seat Type	Clamshell seat. Can adjust dump (4 settings) S: 12-13", M: 14-15" and L: 16-17"
			Shock	Coilover shock with adjustments for rebound and high/low compression
			Fixed Load?	No
			Load Assist?	Yes, gas struts requires minimal assistance from sitskier
			Binding	Custom bindings. Can remove skis from sitski. Can change CoM easily.
			Maintenance	9/10
			Ski(s)	Extreme short radius, asymmetrical skis only (i.e. "Banana" Skis)
			Quad Setup?	Fixed outriggers available T-handle bar for sitskier available
			Surface Lift?	Not from manufacturer but can be retrofitted
			Additional Information	Weighs approx. 45 lbs. including skis Rear handle bar is partially removable & is adjustable for height

Hands On Concepts (HOC) Glide		<p>Beginner to intermediate level of skiers that require lower centre of balance and bi-skis for stability</p> <p>Angulates as close to a monoski as possible (very fluid articulation)</p> <p>Solid program ski</p> <p>Can be a little more tricky to tether (can tend to ski/pivot with less experienced tethers)</p> <p>Load lock/unlock easily accessible by independent skier</p> <p>Most skiers find it relatively easier to manoeuvre in load-assist position</p> <p>MUST NEVER leave fixed outrigger mounting on sitski when using as a biski (i.e. with handheld outriggers)</p> <p>Best to tether from high attachment points.</p>	Seat Type	Clamshell
			Shock	Coilover mountain bike shock. Springs can be replaced. Adjustable for rebound and compression
			Fixed Load?	No
			Load Assist?	Yes, gas pistons.
			Binding	Custom bindings. Cannot easily remove skis from bindings on a daily basis
			Maintenance	9/10 (sitski itself is bulletproof; lose 1 point for difficulty in switching skis, storing at end of day)
			Ski(s)	Can use any of: Extreme short radius, asymmetrical skis only (i.e. "Banana" Skis) Short radius biskis (HOC provides) Shorter radius standard parabolic skies (e.g. 14 to 18m)
			Quad Setup?	Yes, fixed outriggers available T-handlebar available
			Surface Lift?	Not from manufacturer but can be retrofitted.
			Additional Information	Instructor handle is fully removable and is also adjustable.


Mountain Man FFS Dual Ski		<p>Fantastic program ski</p> <p>Most common program biski used</p> <p>Beginner to intermediate level of skiers</p> <p>Good for all levels of disability (to learn)</p> <p>Is very difficult to self-load due to how the sitski separates for loading (45 degree angle)</p> <p>Shock Spring Rates:</p> <p>Red Spring: Skier weighs over 85 kg (185 lbs.)</p> <p>Green Spring: Skier weighs between 68 kg and 85 kg (150-185 lbs.)</p> <p>Blue Spring: Skier weighs less than 68 kg (150 lbs.)</p>	Seat Type	Fixed, high back. Not adjustable. Cannot change the dump
			Shock	Older models have air shocks. New models have coilover spring shocks with compression adjustments.
			Fixed Load?	No
			Load Assist?	No
			Binding	Custom binding but can remove skis easily.
			Maintenance	8/10. Front foot faring's tend to get beaten up, over time frame gets loose. Fixed pontoon blades break over time. Plastic articulator will break overtime due to exposure to cold and UV. Having said this, the sitski is very easy to fix and maintain due to its simplicity.
			Ski(s)	Can use any of: Extreme short radius, asymmetrical skis only (i.e. "Banana" Skis) Short radius biskis (HOC provides) Shorter radius standard parabolic skies (e.g. 14 to 18m)
			Quad Setup?	Yes, fixed outriggers Handlebar

			Surface Lift?	Not from manufacturer but can be retrofitted.
			Additional Information	New models have an instructor handlebar at the back. Not removable and not adjustable. Can be ordered as a retrofit.
Tessier Tempo Dual ski		<p>Beginner to advanced skiers that requires or likes a bi-ski set up for stability and balance.</p> <p>Centre of balance is much higher than HOC and Dynamic</p> <p>Easier to self-load</p> <p>Independent to semi-independent sitskiers.</p> <p>Can be converted to a Tempo monoski</p>	Seat Type	Clamshell. Can order in plastic or carbon fibre.
			Shock	Shock or coilover shock. Both shock models tend to have limited rebound and compression control.
			Fixed Load?	No
			Load Assist?	Yes, gas piston assist, locks into load position.
			Binding	Uses high DIN (18+) all metal standard bindings. Footplates are 320mm.
			Maintenance	9/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Quad Setup?	No
			Surface Lift?	Yes, available from manufacturer
			Additional Information	Assistance bar is available and removable. Available with knee/foot fairings Weighs approx. 17-19 kg


Tessier Scarver Dual Ski		<p>Intermediate to advanced skiers that prefer a bi-ski setup.</p> <p>Independent to semi-independent siskiers.</p> <p>Can be converted to a Scarver monoski</p>	Seat Type	Clamshell. Can order in plastic or carbon fibre.
			Shock	Selection of coilover shocks allowing for rebound and compression control
			Fixed Load?	No
			Load Assist?	No, athlete uses outriggers to lift.
			Binding	Uses high DIN (18+) all metal standard bindings. Footplates are 320mm.
			Maintenance	10/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Quad Setup?	No
			Surface Lift?	Yes, available from manufacturer
			Additional Information	<p>Minimum of 17 kg. (Options will add weight)</p> <p>Can order carbon fiber knee and foot faring's</p> <p>Can adjust CoM (smaller adjustment range than monoski)</p>


<p>Tessier Snow'Kart Ski</p>		<p>Designed to provide an independent ski experience for athletes who lack upper body strength or don't have enough balance for a traditional biski</p> <p>Biski with the skis set very far apart for stability</p> <p>Lever can be added to change one ski angle to drive turns</p> <p>Different "easy drive" configurations available,</p> <p>One-handed/armed athletes can use this sitski independently</p> <p>Ski effectively skis in a shallow snowplow to turn</p>	<p>Seat Type</p>	<p>Clamshell. Can order in plastic or carbon fibre. 7 sizes available</p>
			<p>Shock</p>	<p>Yes, but style is unknown</p>
			<p>Fixed Load?</p>	<p>No. Can also lock into load position</p>
			<p>Load Assist?</p>	<p>Yes, strong gas shock assist.</p>
			<p>Binding</p>	<p>Uses high DIN (18+) all metal standard bindings. Footplates are 320mm.</p>
			<p>Maintenance</p>	<p>Unknown</p>
			<p>Ski(s)</p>	<p>Any standard parabolic ski mounted with a high DIN binding.</p>
			<p>Quad Setup?</p>	<p>No, but is not required with this ski</p>
			<p>Surface Lift?</p>	<p>Yes, available from manufacturer</p>
			<p>Additional Information</p>	<p>Assistance bar is available and fully removable.</p> <p>Weight is approximately 21-24 kg based on options selected</p>


Older or Obsolete Biski Reference Chart


Isoski		<p>Relatively high centre of gravity Intermediate skiers only Not suitable for athletes with higher level injuries. High/aggressive dump limits athletes with lower level from angulating Sitski is capable of creating a significant amount of edge (inclination)</p>	Seat Type	Fixed, high back. No adjustment for dump Aggressive dump
			Shock	Coilover, limited adjustments
			Fixed Load?	No
			Load Assist?	Yes, lever style
			Binding	Custom bindings. Can remove sitski from skis. Can adjust CoM (where you mount the bindings)
			Maintenance	6/10
			Ski(s)	Requires a flattop ski. Can be any parabolic suitable for the skier.
			Quad Setup?	No
			Surface Lift?	No
Additional Information	Load Assist lock/unlock often sticks. Very heavy sitski			


Current/Recent Monoski Reference Chart


Monoski	Picture	Skier Profile	Additional Information	
Dynaccess Torque 1 & Torque 2		<p>Ideal for athletes with lower level injuries</p> <p>Athletes with higher level injuries can use but may find it more difficult due to tall center of gravity</p> <p>Great ski for beginner through advanced skiers</p> <p>Considered a tall sitski (40cm/16")</p> <p>Sits relatively far forward on chairlift making some athletes uncomfortable</p> <p>2 different setups. Torque 1 has 40 degree dump. Torque 2 dump is 28 degrees. Can retrofit dump angles by using spacers.</p>	Seat Type	One piece plastic, but can order custom Aspen Seating/Ride Designs clamshell seats
			Shock	Coilover (single or dual rate) shock or Custom Air Shock. Both offer high and low rebound and compression settings
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. 325 mm CoM can be adjusted by 7"
			Maintenance	10/10. Solid chromoly
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Not from manufacturer. Can be retrofitted.
			Additional Information	Adjustable ride heights available No knee or foot fairings available from manufacturer Weighs approx. 12 kg (26 lbs.)


<p>Dynaccess Tensor</p>		<p>Considered a tall sitski Sits back on the chairlift much more than Torque 1 & 2. Adjustable ride height from 7-20" Good program ski; very adjustable Good for all level of injuries, although higher injuries may feel balance is difficult due to tall Has double AK option Optimal for racing/competitive skiing</p>	<p>Seat Type</p>	<p>One piece plastic, but can order custom Aspen Seating/Ride Designs clamshell seats</p>
			<p>Shock</p>	<p>Coilover (single or dual rate) shock or Custom Air Shock. Both offer high and low rebound and compression settings</p>
			<p>Fixed Load?</p>	<p>Yes</p>
			<p>Load Assist?</p>	<p>No</p>
			<p>Binding</p>	<p>Standard high DIN. 325 mm CoM can be adjusted 7"</p>
			<p>Maintenance</p>	<p>10/10</p>
			<p>Ski(s)</p>	<p>Any standard parabolic ski mounted with a high DIN binding.</p>
			<p>Surface Lift?</p>	<p>Not from manufacturer. Can be retrofitted.</p>
			<p>Additional Information</p>	<p>Weighs approx. 11 kg (23 lbs.)</p>


Dynaccess Hydra		<p>Considered a tall sitski</p> <p>Ideal for athletes with lower level injuries</p> <p>Intermediate to advanced skiers</p> <p>Has double AK option</p> <p>Optimal for racing/competitive skiing</p>	Seat Type	One piece plastic, but can order custom Aspen Seating/Ride Designs clamshell seats
			Shock	Dual rate coilover shock with high and low rebound and compression settings
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. 325 mm
			Maintenance	10/10. CNC'd frame, very strong.
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Not from manufacturer. Can be retrofitted.
			Additional Information	


<p>Enabling Technologies ET Mono-ski</p>		<p>Adult, Junior and Child models (different footrests, accommodates athletes from 4'1" to 6'3")</p> <p>Two frame heights – low and high</p> <p>Can customize the frame colour</p> <p>Can sit as low as 12" from snow</p> <p>Aimed to bridge the gap between novice and race sitskis</p> <p>Designed to create a slower edge to edge</p>	<p>Seat Type</p>	<p>Clamshell. 3 sizes (small 12/13", medium 14/15" and large 16/17")</p> <p>4 positions to adjust dump</p>
			<p>Shock</p>	<p>Coilover in 300 lbs, 400 lbs and 500 lbs spring rates. 5" of travel.</p>
			<p>Fixed Load?</p>	<p>No</p>
			<p>Load Assist?</p>	<p>Yes</p>
			<p>Binding</p>	<p>Standard high DIN. 325 mm</p>
			<p>Maintenance</p>	<p>Unknown (introduced 2018)</p>
			<p>Ski(s)</p>	<p>Any standard parabolic ski mounted with a high DIN binding.</p>
			<p>Surface Lift?</p>	<p>Not from manufacturer. Can be retrofitted.</p>
			<p>Additional Information</p>	<p>Instructor handle is available and fully removable</p> <p>3" CoM adjustment available</p>


<p>Hands On Concepts (HOC) Groove</p>		<p>Great program ski Great ski for beginner to intermediate independent or semi-independent skiers Good for all levels of injury/disability</p>	Seat Type	Clamshell No dump adjustments, cannot retrofit
			Shock	Ohlins with compression and rebound adjustments. 6" travel.
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. 305 mm
			Maintenance	10/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	No standard; can be retrofitted.
			Additional Information	Fully billeted aluminum 12 kg (26 lbs.) Can adjust CoM by 3cm


<p>Hands On Concepts (HOC)</p> <p>Edge</p>		<p>Lower level injuries</p> <p>Intermediate/advanced skiers</p> <p>More difficult for high-level in/beg. Skiers</p> <p>Single pivot point can cause some athletes to experience leg spasms</p> <p>Considered a “tall” sitski – great for creating higher angles but may be more difficult for intermediate skiers (higher centre of balance)</p> <p>Has double AK option</p> <p>Optimal for racing/competitive skiing</p>	Seat Type	Carbon fiber, clamshell
			Shock	Cane Creek Mountain bike with compression and rebound control. Offers 8” travel.
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. 305 mm
			Maintenance	10/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Not standard; can be retrofitted.
			Additional Information	<p>Three frame sizes available (extra short, regular, and extra tall).</p> <p>Fully billeted aluminum & zinc hardware</p> <p>Can adjust CoM by 3cm</p>


KGB Lynx		<p>Very adjustable ski makes it an ideal program ski</p> <p>All levels of skiers from beginner to advanced</p> <p>All injury levels</p>	Seat Type	Clamshell, but can fit many different options including no back, 6", 8", 10" and 12" options. Seat widths: 12", 14", 16" and 18" Can adjust dump angles
			Shock	Elke mountain bike shock with high/low compression
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. Can adjust CoM forward/aft.
			Maintenance	
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding
			Surface Lift?	Not standard; can be retrofitted.
			Additional Information	Very light ski (about 19 lbs.) CNC Machined


KGB Celes		<p>Best for lower level injuries</p> <p>A capable sitski for beginners through advanced skiers</p> <p>Designed primarily for expert skiers and racers</p> <p>Highly adjustable, especially with multiple seating positions</p> <p>A very tall sitski (high center of gravity) may make it difficult for athletes with higher level of injury</p>	Seat Type	Clamshell, but can fit many different options including no back, 6", 8", 10" and 12" options. Seat widths: 12", 14", 16" and 18" Can adjust dump angles
			Shock	Elke coilover with adjustments for rebound and compression
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. Can adjust CoM forward/aft.
			Maintenance	
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding
			Surface Lift?	Not standard; can be retrofitted.
			Additional Information	CNC Machined


KGB Homage		<p>All injury levels</p> <p>All level of skiers (beginner to advanced)</p> <p>Good for larger, heavier skiers</p>	Seat Type	<p>Clamshell, but can fit many different options including no back, 6", 8", 10" and 12" options.</p> <p>Seat widths: 12", 14", 16" and 18"</p> <p>Can adjust dump angles</p>
			Shock	Elka coilover shock with rebound and high/low compression settings
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. Can adjust CoM forward/aft.
			Maintenance	
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding
			Surface Lift?	Not standard; can be retrofitted.
			Additional Information	<p>Good adjustability</p> <p>Lighter design of the original KGB</p> <p>Weighs approx. 23 lbs.</p> <p>CNC Machined</p>



KGB Taja		<p>All injury levels Intermediate to advanced skiers Optimal for racing/competitive skiing</p>	Seat Type	Clamshell, but can fit many different options including no back, 6", 8", 10" and 12" options. Seat widths: 12", 14", 16" and 18" Can adjust dump angles
			Shock	Elka coilover shock with rebound and high/low compression settings
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN. Cannot adjust CoM forward/aft.
			Maintenance	
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding
			Surface Lift?	
			Additional Information	Good adjustability Lighter design of the original KGB Weighs approx. 20 lbs. CNC Machined


Nissin		<p>Good program ski</p> <p>Very mobile, easy to use for independent and semi-independent skiers</p> <p>All levels of skiers</p>	Seat Type	Clamshell. Can be ordered in plastic or carbon fiber.
			Shock	Elka. 5" travel. High and low rebound/compression control
			Fixed Load?	No
			Load Assist?	Yes. Gas assist struts available.
			Binding	Standard high DIN. 310 mm
			Maintenance	7/10. Load Assist mechanism is finicky. Footrest known to break.
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Unknown from manufacturer but can be retrofitted.
			Additional Information	Highly adjustable dump and footrest positions. CoM can be modified (5") Can order race foot/knee faring's


<p>Praschberger Bullet</p>		<p>Race or expert model of the Praschberger monoski</p> <p>Low to mid-level of SCIs</p> <p>Similar skiing to monoski model but more robust</p> <p>Good for all levels of independent and semi-independent skiers</p> <p>Optimal for racing/competitive skiing</p>	<p>Seat Type</p> <p>Shock</p> <p>Fixed Load?</p> <p>Load Assist?</p> <p>Binding</p> <p>Maintenance</p> <p>Ski(s)</p> <p>Surface Lift?</p> <p>Additional Information</p>	<p>Clamshell, sizes 34 cm to 42 cm, backs 25 cm to 40 cm</p> <p>No adjustment for dump</p> <p>High-end racing shock with high and low rebound/compression control</p> <p>No. Frame separates for load</p> <p>No, athlete uses outriggers</p> <p>Standard high DIN. 320 mm</p> <p>9/10</p> <p>Any standard parabolic ski mounted with a high DIN binding.</p> <p>Yes. Available from manufacturer</p> <p>Frame milled from 7075 aluminum</p> <p>Weighs approx. 13 kg</p> <p>Cannot adjust CoM on footplate</p> <p>Can retrofit spacers for dump</p> <p>Can order race foot/knee farings</p>
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Praschberger Monoski		<p>Great program mono ski</p> <p>Good for athletes that like chair-like foot position</p> <p>Athletes find it easy to load, though the off-load may be more difficult</p> <p>Very mobile, easy to use for independent and semi-independent skiers</p>	Seat Type	Clamshell, sizes 34 cm to 42 cm No adjustment for dump
			Shock	Coilover with compression and rebound controls
			Fixed Load?	No. Frame can separate for load.
			Load Assist?	No, athlete uses outriggers
			Binding	Standard high DIN. 320 mm
			Maintenance	7/10. Easy to maintain but manufactured with stainless bolts straight through aluminum (eventually wears). Stock shock (White Power) does not like cold weather (-25 C and below)
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Yes. Available from manufacturer
			Additional Information	Weights approx. 13kg Frame is primarily tube bent aluminum Cannot adjust balance of ski on footplate Can retrofit spacers for dump. Can order race foot/knee faring's



Praschberger Snowball		<p>Junior model of the Praschberger monoski</p> <p>Good for athletes that like chair-like foot position</p> <p>Athletes find it easy to load, though the off-load may be more difficult</p> <p>Very mobile, easy to use for independent and semi-independent skiers</p>	Seat Type	Clamshell, sizes 28 cm to 34 cm, backs from 25 cm to 35 cm No adjustment for dump
			Shock	Coilover with compression and rebound controls
			Fixed Load?	No. Frame can separate for load.
			Load Assist?	No, athlete uses outriggers
			Binding	Standard high DIN. 320 mm
			Maintenance	7/10. Easy to maintain but manufactured with stainless bolts straight through aluminum (eventually wears). Stock shock (White Power) does not like cold weather (-25 C and below)
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Yes. Available from manufacturer
			Additional Information	Rear handle bar comes standard and is removable. Cannot adjust CoM on footplate Can retrofit spaces for dump.

Tessier Tempo Access		<p>Intended for children and/or athletes with limited balance</p> <p>Beginner to Intermediate</p> <p>Very low gravity centre (less than 20 cm) → about 10 cm less than most monoskis.</p>	Seat Type	Clamshell.
			Shock	
			Fixed Load?	No
			Load Assist?	Yes, strong gas shock can lift athlete without using outriggers.
			Binding	Standard high DIN. 325 mm
			Maintenance	9/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Yes. Available from manufacturer
			Additional Information	Assistance bar is available and removable.
Tessier Tempo Uniski		<p>Same frame as the Duoski; different frame to ski fitting</p> <p>Can purchase both duo and uniski adjustments</p> <p>Great program ski to allow both biski and monoski ability</p> <p>Good for all levels of independent and semi-independent skiers</p> <p>All levels of skiers</p> <p>Available with knee/foot fairings</p>	Seat Type	Clamshell
			Shock	Ohlins coilover shock with rebound and compression control
			Fixed Load?	No
			Load Assist?	Yes. Includes 2 gas struts.
			Binding	Standard high DIN. 325 mm
			Maintenance	9/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	Yes. Available from manufacturer



		Weighs approx. 15-18 kg	Additional Information	Assistance bar is available and removable.
Tessier Scarver		<p>Best for lower level SCI injuries</p> <p>Can be more difficult for high level injuries and/or beginners</p> <p>Intermediate to Advanced skiers</p> <p>Can change suspension travel kinematics</p> <p>Seating angle (dump) can be adjusted from 30-40 degrees in 2 degree increments</p> <p>Can convert to biski</p> <p>Optimal for racing/competitive skiing</p> <p>Considered a relatively “tall” sitski with a higher centre of gravity</p>	Seat Type	Clamshell. Can order in plastic or carbon fibre.
			Shock	Selection of coilover shocks allowing for rebound and compression control
			Fixed Load?	No
			Load Assist?	No, athlete uses outriggers to lift.
			Binding	Standard high DIN. 325 mm
			Maintenance	10/10
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Additional Information	<p>Available 2 heights of monoski base</p> <p>Minimum of 16 kg. (Options will add weight)</p> <p>Can order carbon fiber knee and foot farings</p> <p>Can adjust CoM (7 cm)</p>

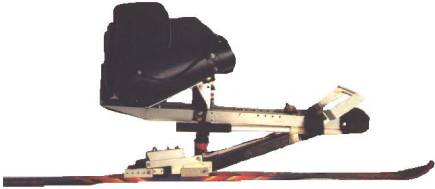
Turtle Ridge TRF Monoski		<p>Low center of gravity makes this ski ideal for beginners to intermediate skiskiers</p> <p>Being a low ski with no lift assist, it can be difficult to load onto the chairlift for athletes with higher level injuries or very small athletes</p>	Seat Type	Clamshell designs by Aspen Seating/Ride Designs
			Shock	Ohlins coilover with rebound and compression adjustments
			Fixed Load?	Yes
			Load Assist?	No.
			Binding	Standard high DIN. No CoM adjustment.
			Maintenance	
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	No
			Additional Information	Constructed of 6061 aluminum CNC frame

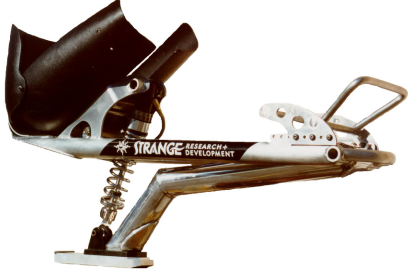
Older and Obsolete Monoski Reference Chart


Grove Innovations			Seat Type	Clamshell
			Shock	Carrera GRV-4 coilover shock.
			Fixed Load?	No
			Load Assist?	Yes, lever style.
			Binding	Custom binding. Optional boot system mount available to allow use of high DIN bindings
			Maintenance	
			Ski(s)	Requires a flattop ski. Can be any parabolic suitable for the skier.
			Surface Lift?	No
			Additional Information	
Hall MT Extreme		<p>Not suitable for athletes with higher level SCI (back is much too low)</p> <p>Has significant travel with shock</p> <p>Known for a softer ride</p> <p>Low centre of gravity</p> <p>Best for beginners and intermediate skiers</p>	Seat Type	Molded seat
			Shock	Coilover.
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Custom binding, sitski is bolted to ski
			Maintenance	
			Ski(s)	Requires a flattop ski. Can be any parabolic suitable for the skier.

			Surface Lift?	No
			Additional Information	
KGB (old style mono)	(no picture available)	Ideal for lower level injuries Intermediate and advanced skiers Considered a tall sitski, edgy Has double AK Option	Seat Type	
			Shock	Ohlins, coilover with adjustable compression and rebound control
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN.
			Maintenance	Sturdy frame.
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	
			Additional Information	Weights approx. 33 lbs.

Freedom Factory Revolution Pro SS		All level of injuries All level of skiers, but predominately suitable for beginner to intermediate	Seat Type	Clamshell
			Shock	Base model is an air shock with limited adjustment. Can upgrade to a coilover with rebound and compression adjustments
			Fixed Load?	No
			Load Assist?	Optional load assist available
			Binding	Standard high DIN.
			Maintenance	
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	None standard; can be retrofitted
Additional Information	Stock seat can be unstable for athletes with a higher level injury			
Freedom Factory Mogul Master		Lower foot position Beginner to intermediate skiers	Seat Type	Fixed, high back. Back can be retrofitted lower if required.
			Shock	
			Fixed Load?	No
			Load Assist?	Yes, lever style.
			Binding	Custom bindings from Freedom Factory.
			Maintenance	8/10 (some issues with frame strength)

			Ski(s)	Requires a flattop ski. Can be any parabolic suitable for the skier.
			Surface Lift?	No.
			Additional Information	
Shadow		<p>Ski is very low to the ground; low centre of gravity</p> <p>Was considered revolutionary in its day</p> <p>If still used, suitable for beginners only</p> <p>Not suitable for athletes with higher level of injury due to lower back on seat</p>	Seat Type	Clamshell. Able to adjust dump
			Shock	
			Fixed Load?	No
			Load Assist?	Yes, lever style.
			Binding	Custom bindings, bolted to sitski
			Maintenance	
			Ski(s)	Requires a flattop ski. Can be any parabolic suitable for the skier.
			Surface Lift?	No
			Additional Information	Much older design and should be retired from inventory

Strange R+D F1		<p>Built to be bullet proof and capable of high speeds and big air</p> <p>Suitable for intermediate and advanced skiers looking to be aggressive with the equipment</p> <p>The design is known to be prone to broken skis (in front of footplate) if jumped or skied very aggressively</p>	Seat Type	Fixed seat. Optional clamshell available (Low back). Cannot adjust dump.
			Shock	Coilover with remote reservoir. Rebound and compression adjustment
			Fixed Load?	Yes
			Load Assist?	No
			Binding	Standard high DIN.
			Maintenance	10/10 (except for replacing skis!)
			Ski(s)	Any standard parabolic ski mounted with a high DIN binding.
			Surface Lift?	No
Additional Information	Very heavy (30+ lbs.) T061 aluminum and chromoly			

Yeti HPD		<p>Available in 2 sizes (adult and junior)</p> <p>Due to high (aggressive dump) athletes with lower level injuries may find uncomfortable (and will not be able to angulate effectively)</p>	Seat Type	Fixed shell. Lower back. Very high dump; dump cannot be adjusted
			Shock	
			Fixed Load?	No
			Load Assist?	Yes, lever style

		<p>Very low to the ground makes this an ideal beginners sitski</p> <p>Tends to bobble towards feet on bumpy days, throwing sitskier forward and out of position</p> <p>Even with load assist, can be a difficult load due to how low the sitski sits to the ground</p>	<p>Binding</p> <p>Maintenance</p> <p>Ski(s)</p> <p>Surface Lift?</p> <p>Additional Information</p>	<p>Custom Yeti bindings. Can detach sitski from ski.</p> <p>Can adjust CoM (sliders)</p> <p>10/10</p> <p>Requires a flattop ski. Can be any parabolic suitable for the skier.</p> <p>No</p>
<p>Yeti Racer</p>		<p>Athletes with low level injury</p> <p>Many athletes find this ski more difficult to load</p> <p>Low foot position can lead to boot-out on extreme turns or on steeper terrain</p> <p>High centre of gravity</p> <p>Best for intermediate to advanced skiers</p>	<p>Seat Type</p> <p>Shock</p> <p>Fixed Load?</p> <p>Load Assist?</p> <p>Binding</p> <p>Maintenance</p> <p>Ski(s)</p> <p>Surface Lift?</p> <p>Additional Information</p>	<p>Fixed seat, low back</p> <p>Penske, coilover, remote reservoir. Adjustable rebound and compression.</p> <p>No</p> <p>No</p> <p>Standard high DIN</p> <p>Can adjust CoM</p> <p>Any standard parabolic ski mounted with a high DIN binding.</p> <p>No, but can be retrofitted.</p>

Contact Information for Sitski Manufacturers

This information accurate as of November 2018. Manufacturers that have closed are not listed. The manufactures are listed alphabetically.

Manufacturer	Country of Origin	Website	Contact Information
Dynaccess	United States of America	http://dynaccessltd.com	DynAccess Ltd. 301 Broadway, #M100-E Bethlehem, PA 18015 Tel. +1 (484) 767-0477 info@dynaccessltd.com
Enabling Technologies	United States of America	https://enablingtech.com	2200 S Jason St Denver, CO 80223, USA Tel. +1 (303) 578-9345 info@enablingtech.com
Hands On Concepts	United States of America	http://teamhoc.com	1330 LA CRESTA BLVD. EL CAJON, CA 92021 Tel. +1 (619) 441-9995 <u>Tel. +1 (877) 375-6257</u> info@teamhoc.com
KGB	United States of America		Sold exclusively through Enabling Technologies .
Nissin	Japan		Various distributors throughout the world

Mountain Man	United States of America		720 Front St Bozeman, Montana 59715 United States Tel. +1 (406) 587-0310
Praschberger	Austria	http://www.praschberger.com	Rolltechnik & Sport GmbH Sebi 9 A-6342 Niederndorf Tel. +43 (0) 5373 / 42570 rolltechnik@praschberger.com
Tessier	France	http://www.dualski.com	73660 St Rémy de Maurienne France Tel : +33 (0) 479.83.51.52 info[a]dualski.com
Turtle Ridge Foundation	United States of America	http://www.turtleridgefoundation.org	PO Box 10 461 Main Street, Suite 6A Franconia, NH 03580 Tel. +1 (603) 616-5030

Appendix C: Understanding Ski Technology and Terminology

Today's skis are almost exclusively designed as "parabolic" skis meaning that they have an 'hour glass' shape designed to help skis carve when on edge. This reference guide will not discuss the older straight ski models.

The ski industry uses the following terms to describe their ski geometry and characteristics:

- ✓ Ski Type
- ✓ Gender-specificity (primarily designed for male or female athletes)
- ✓ Ability Level of Skier
- ✓ Ski Length and Width
- ✓ Side cut and Turning Radius
- ✓ Camber and Rocker

Type of Skis

All mountain – the alpine all-rounder of the ski family. All mountain skis are capable of tackling a wide range of terrain and snow conditions. You can find beginner, intermediate, and advanced all mountain skis at any ski shop.

Twin tip – park skis, all mountain skis, and even powder skis are available in twin tip models. 'Twin tip' refers to any ski that features a tail profile that is turned up, similar to the tip (or shovel), allowing them to be skied backwards (or switch) without catching.

Powder – if you are a seeker of glorious fresh pow, these are the skis for you. Powder skis are wider than other ski types to help them float on the surface of deep, freshly-fallen snow. Waists of 100-110mm or more, generally softer than a carving or race ski because there is less resistance from the softer snow

Carving – if you like to make hard and fast turns on groomers you want a pair of carving skis. Carving skis feature a more aggressive side cut creating a shorter turning radius and are available for skiers of all skill levels.

Race – designed to go from the top of the piste to the bottom as fast as possible, race skis are designed specifically for competition race events like slalom, giant slalom, and downhill. Race skis tend to be very stiff torsionally and longitudinally and require significantly more force to have them arc in a turn.

Asymmetrical – any of the skis types above may be designed as asymmetrical pairs of skis meaning that the left and right skis have different inside and outside turning radiuses. For this reason, asymmetrical skis of any style are not recommended for use on a monoski.

16.1.1 Gender-Specificity

Skis were once unisex, but many of today's skis are designed to suit both men and women. Compared to men's skis, women's skis are built for smaller, lighter, less powerful frames, and have a waist that's farther forward to better match a woman's relatively lower center of gravity relative to a man.

While either can be used for sitskis, due to the additional weight of the sitski itself, it is generally preferred to use a gender-neutral or men's ski.

Ability Level of Skier

As the ability level of the skier improves, the skis will generally need to be stiffer and slightly longer. Intermediate and advanced skiers will benefit from trying out different ski shapes, turning radiuses, widths, etc.

Ski Length and Width

The length and width of the ski defines the total surface area.

Ski length can be determined by a number of factors, such as height, weight, ability level, and terrain. It can be as simple or as complicated as you want to make it.

Traditionally, standup skiers hold a ski next to them and if it reaches a point just below their nose, it's a good size for the intermediate skier. This technique is still used in rental shops today.

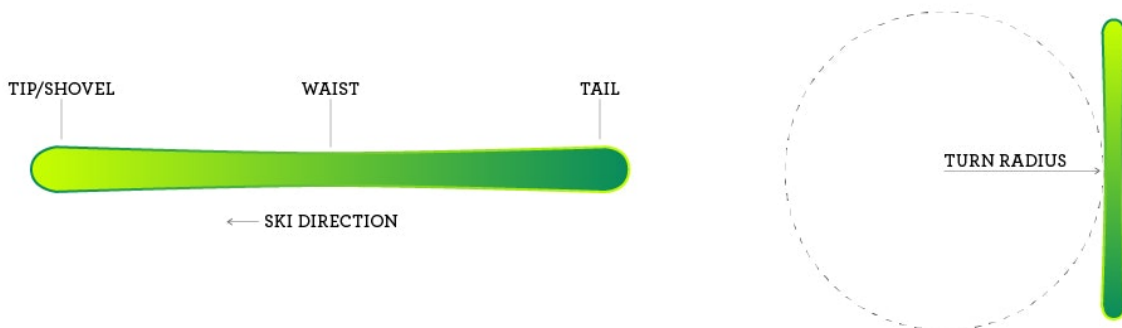
For more advanced skiers or those participating in specific styles of skiing (e.g. slope style, park, races, etc.) shorter or longer skis may be required.

For ski width, the general rule is narrower for firmer, groomed runs and wider for snowier, softer off-piste runs.

Of course the combination of length and width comes into play when deciding on the optimal ski size for an individual. If in doubt, for beginners, go shorter (below the chin) and narrower (70 to 75mm underfoot).

Side cut and Radius

A ski's side cut is the curvature of its effective edge when viewed from above from shovel to tail. The amount of side cut a ski exhibits will affect its turning radius; that is, the length of the arc it naturally makes on the snow once it is flexed while in a turn. Imagine drawing a circle following that natural arc: this is the ski's turning radius. The more pronounced a ski's side cut, the shorter its turning radius. The longer the ski's turning radius the less dramatic that curve will be from tip to tail.



The side cut of the ski is often found on the tail of the ski expressed as three numbers representing the ski's tip width(mm), waist width(mm), and tail width(mm), for example, 129 / 94 / 118. Most manufacturers will also indicate their turning radius, e.g. R18, in meters.

Extreme Short Radius – skis with a turn radius of less than 8 metres. These are typically only found as asymmetrical skis designed for quadski/biskis.

Short Radius – skis with a turn radius of less than 16 metres; designed for fast, short turns

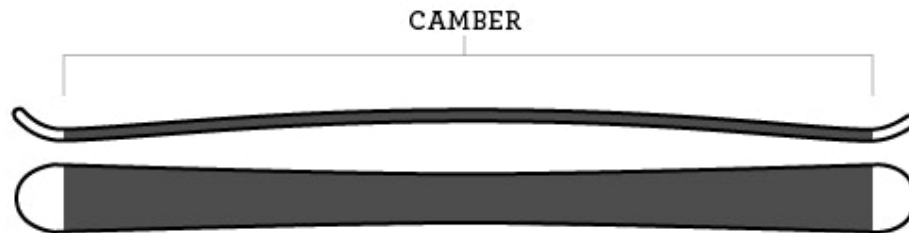
Medium Radius– skis with a radius between 17 and 22 metres and are often used for all mountain skis, park skiing and backcountry activities

Long Radius– skis with a turning radius greater than 22 metres. These are typically powder or big mountain (off piste) skis or are race skis meant for speed events

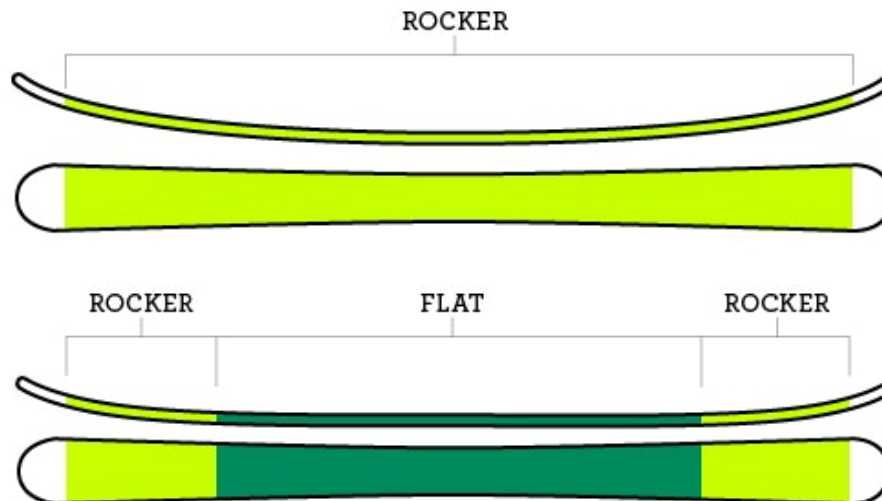
Camber and Rocker

Camber and Rocker describe the ski profile if viewed from the side.

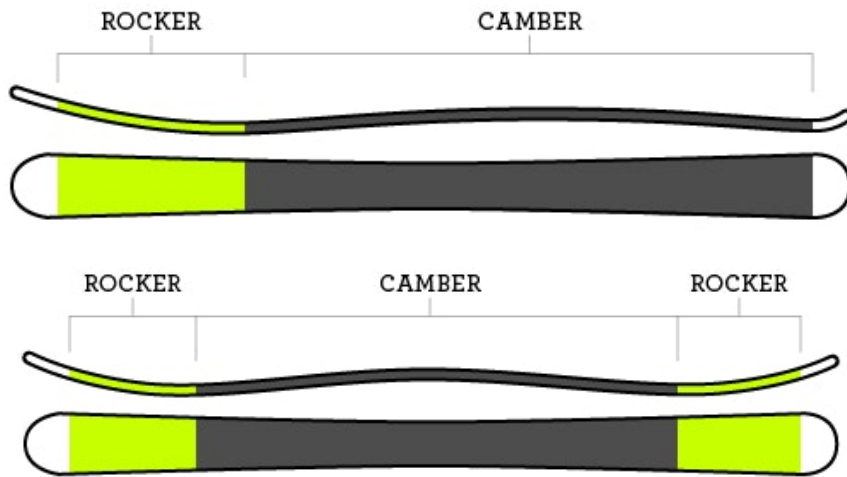
Camber – most traditional profile for skis today where the waist lifts off the snow when unweighted. Camber distributes weight onto the tips and tails, extending the surface area bearing the skier's weight, and thereby improving the amount of ski edge in contact with the surface.



Rocker – is the opposite effect where the waist sits on the snow and the tip and tail curves upwards. While their design makes it easier to initiate a turn, the reduced grip (edge contact) make them significantly harder to turn on hard-packed and groomed runs, especially for a beginner. In powder and deeper snow conditions they are considered more forgiving.



Hybrid – some manufacturers are designing hybrid skis employing both camber and rocker technologies in order to provide a combination of grip for on-piste, groomed runs and off-piste, deeper snow conditions.



Longitudinal (Ski Flex) vs Torsional Rigidity (Ski specific concern)

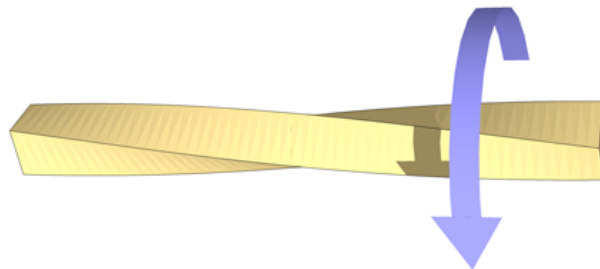
Flex describes the amount of force required to flatten a ski's edge (longitudinally or length wise) to grip the snow. The stiffer the flex, the more force or weight is required to initiate and hold a turn on edge.

Beginner skis tend to have a softer flex than more advanced models making them more forgiving and easier turn, especially at low speeds.

More advanced skiers will often go faster and turn harder than beginners. All that speed and force generated in the turn flattens out the ski along its edge, thus requiring a stiffer flexing ski to hold their edge in the turns.

Depending on the ski manufacturer, and intended use of the ski, they may vary to stiffness of the ski along its length. I.e. having a stiffer tail will make the ski more stable at speed, but have a softer tip to ride up and over variable snow conditions.

Torsional Rigidity describes the amount of resistance the ski has to avoid twisting when the ski is put on edge during a turn.



Skis designed for lighter skiers or for beginners tend to be lighter and made of materials that allow to ski to have a low torsional rigidity. This is not a concern for beginners who tend to put less force on their skis and are skiing slower, often making longer, less aggressive turns.

Conversely, skis designed for more advanced skiers, racers or heavier skiers have technologies such as carbon fiber, titanium, side-to-side banding that limit the twisting of the skis when put on edge.

Torsional rigidity is important in that skiers that can put enough force on the ski (through their weight, skiing style, or power) to have it twist will lose edge control and grip, particularly on hard-packed groomed runs.

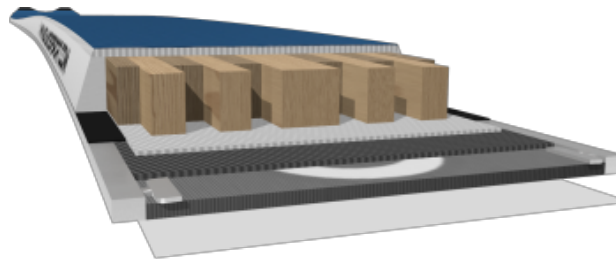
Monoski and three-trackers prefer to have a ski with high torsional rigidity.

It should be noted in many cases ski flex and torsional rigidity are linked. It can be difficult to find skis that have a suitable flex pattern longitudinally yet have a very stiff torsional (twist) resistance. Manufactures such as Elan, with their wave form technology, have started to ensure that their softer flexing skis can still have a stiff torsional rigidity.

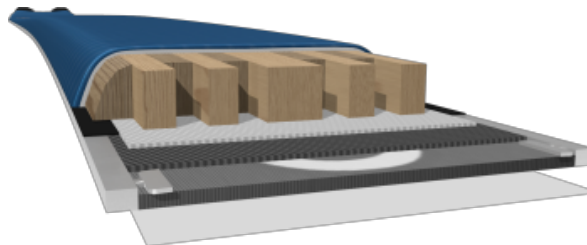
Sidewall vs. Capped Ski Construction

Describes how the manufacturers build and finish the ski.

Sidewall Construction – is the more costly way to build a ski and is most typically used in higher end, more advanced skis. An ABS sidewall is used on the sides to protect the core. While the design promotes greater torsional rigidity, better edge grip and more resistant to impacts, they tend to be heavier and top sheets are prone to chipping (when skis cross).




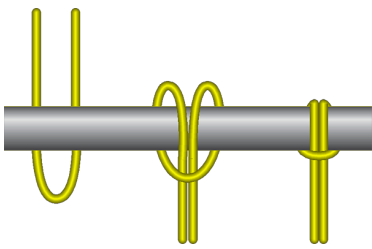
Cap Construction – Skis have their top sheet composite layer brought over the core to seal the edge. This makes the ski cheaper to make, weight less as it forgoes the heavy ABS material, and make the top sheet less susceptible to chipping due to its curved edge. However, it does give up both torsional stiffness and edge grip, especially at higher speeds.



Hybrid Construction – Many manufacturers are designing skis that maximize the benefits of both sidewall and cap construction. The middle of the skis will feature a sidewall construction allowing for greater edge grip and stability but will transition to a capped construction at the tip and tail allowing for reduce prices and increased resistance to damage caused by crossed ski tips. In most cases, the torsional rigidity of the hybrid construction skis is nearing those featuring a full sidewall construction.

Appendix D: Glossary of Terms and Acronyms

360 degree awareness	Ability to fully be aware of other skiers/boarders on the hill ... including those behind (i.e. head on swivel) ... not just knowing what is in front and to side, but also what is behind
Articulator (aka Angulator)	A mechanical device between the biski frame and the skis. It enables the two skis to angle equally when the sitski is turning, allowing both edges to make an even contact with the snow
AOT	A sk, O bserve, T est. The assessment process used by CADS instructors.
Banana skis	Radically parabolic skis used on the biski setup ... typically a 4-6 meter turn radius where the outside edge of the ski is shaped more radically for turning than the inside edge of the ski (to account for turning radius and the fixed articulator) 
Blocker	Additional ski partner used for safety that generally follows a tetherer and sitskier in a position to create a safety zone.
Biski	Sitski that uses 2 skis. These skis have an articulation system that allows the 2 skis mounted in parallel to edge consistently from side to side. Common biskis are the Mountain Man, Enabling Technologies Dynamique, HOC Biski, Tessier Biski. Most (if not all biskis) have a load-assist feature. Most biskis use a custom ski-binding system that physically locks the ski to the sitski with a spring loaded bale that is pretty much fail proof. However if the sitski does use a “standard” binding system, then the binding must either be locked or be at least an 18 DIN binding, preferably all metal binding. The DIN must be set to at least 18 and preferably have a metal (not plastic toe and heel).
Compression (Shock)	Describes how quickly the shock can compress. Many shocks do not have an external High Speed setting – in these cases, compression adjustments are always affecting the low speed compression.

	<p>Low speed: controls for when the suspension compresses slowly, such as a small bumps or during turns (caused by centrifugal force)</p> <p>High speed: Controls the compression speed when the suspension compresses very quickly, such as hitting a rock or landing a jump or drop</p> <p>“+” will make the shock feel stiffer</p> <p>“-“ will make the shock feel softer</p>
Center of Mass (CoM)	<p>A point representing the mean position of the matter in a body or system.</p> <p>In this context, the middle position (fore/aft) of weight of the sitskier and sitski combined as measured from the middle of the sitski boot.</p>
Crutch position (outrigger)	<p>Position of outriggers when they are used to navigate at slow / walking speeds. There are generally spikes on the outrigger which can be used to grip the snow or ice.</p>
DIN	<p>DIN stands for Deutsches Institut für Normung (German Institute for Standardization) and is the industry standard scale for release force settings for ski bindings.</p> <p>The setting is based on weight, height, ability level, and boot sole size of the skier and determines the force required to eject from the binding.</p>
Fixed outrigger	<p>Fixed outriggers (aka pontoons) are designed to create a “quadski” set up and limit the amount of lean a biski has during a turn. They are ski tips mounted to bars that attach to the side of a sitski.</p>
Following the ski	<p>When a tetherer is directly behind the sitskier and not “leading a turn”</p>
Girth Hitch	<p>A knot commonly tied with a sling of webbing using pre-sewn loops. Other names for this knot are the Ring Hitch, Strap Knot and Bale Sling Hitch.</p> 
Handheld Outrigger	<p>Handheld outriggers are the ski poles used by independent or semi-independent sitskiers (and other athletes). They most</p>

	commonly have short ski tip attachments at the end. Some models allow the ski tips to flip up to create a crutch position (for lifting and poling) and down for the ski position. Other models have a fixed ski position.
High-side (fall)	falling down the hill ... it's called a high-side because it's the furthest distance to fall
Inside tether	The tether that is on the "inside" of the turn; the tether that is "up hill" ... for right turns (right tether), left turns (left tether). Typically the "low" tether
Leading the turn	When a tetherer is getting inside the turn prior to the skier being on edge and initiating the next turn
Loose-tether	A technique where the tether is loose and is not being used to control the ski → skier is responsible to controlling turn and/or maintaining balance
Mono-ski	Sitski that uses a single ski. Most mono-skis have a "boot adapter" that allows for use of "standard" bindings. The binding must either be locked (pinned) or be at least an 18 DIN binding, preferably all metal binding. The DIN must be set to at least 18
Outside tether	The tether that is on the "outside" of the turn; the tether that is "down hill" ... for right turns (left tether), left turns (right tether). Typically the "high" tether
Papa Joe	A simple device which is basically a 2 foot long pole with tethers attached at each end which can be held at waist level to tether a stand up skier. Much like sitski tethering it can be used to slow or assist in turning a skier. Picture required
Physical literacy	Describes a person's exposure and capacity to perform the fundamental movement skills. Fundamental movement skills are specific sets of skills that involve different body parts and are the building blocks for the more complex and specialized skills athletes require to participate in games, sports and recreational activities. Fundamental movement categories include: <ul style="list-style-type: none"> ✓ Balance ✓ Locomotor skills such as walking*, running*, jumping, hopping ✓ Ball skills such as catching, throwing, kicking, striking

	* this includes persons with a disability when using wheelchairs or mobility devices – if they are moving in a direction at varying speeds and abilities then they demonstrating locomotor skills
Pivot	Skis flat, skidded turn, etc.
Quadski	Sitski that uses two skis and fixed outriggers (i.e. 4 running surfaces)
Rebound (Shock)	<p>Describes the amount of force pushing back on the shock to return to the “fully extended” stroke. i.e. how quickly the suspension can extend after being compressed.</p> <p>Low speed: controls the speed of extension following smaller compressions</p> <p>High speed: controls the speed of extension following a deep compression and effects the suspensions ability to recover following multiple impacts.</p> <p>“+” will make the shock return <i>slower</i> to full extension</p> <p>“-“ will make the shock return <i>faster</i> to full extension</p>
“Sandy”	A weighted dummy or device used to approximate the weight of a sitskier when training new tetherer. Weighted sitskis operate differently than unweighted sitskis. “Sandy” was coined as most programs use several taped up sandbags to approximate 50 to 75 pounds.
Single tether	A single tether used for safety and/or speed control. Used for skiers with outriggers as they progress towards
Tetherer	Person that is attached to the tethers responsible for steering, slowing, management the safety of a skier (sitskier)
Terrain management	Ability to use the terrain to your advantage when tethering (e.g. to initiate a turn or slow down the ski)
Thumbing	When a tether use their hands and/or thumbs to control the sitski from the backrest or handle and not using the tether(s)
Wrapping	Wrapping the tethers around your hands to take up slack and manage the tether length.