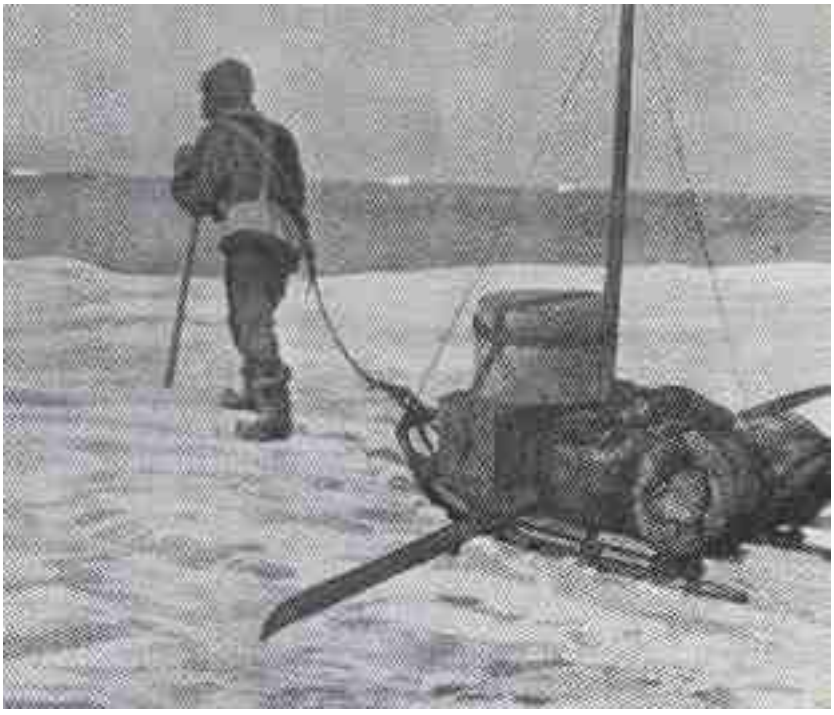
Table of Contents

Chapter 1. History of the "Pulk"

As long as humans have lived in winter environments they have been designing devices for dragging or pulling loads across the snow and ice. The term used in western history for these gear hauling sleds has been "sledge". In more recent years a more popular name for the smaller sledges has been pulk. According to Webster the name comes from the Norwegian "pulkha" which is what natives of Lapland called their small sledges hauled by people or reindeer. According to the internet log of the recent M&G ISA British female expedition to Antarctica's :

> *"Pulk – A rare species found mostly within the Arctic Circle and Antarctica, its' name stems from a Norwegian word 'pulken', simply translated as 'sledge'. The verb used for those daft enough to want to pull one is 'sledgehauling'. This has superseded the now passé euphemism of 'manhauling', a verb now confined to the days when Polar travel was largely limited to the male bastion. This was before girls like ourselves neutralized the verb by taking to the frozen Polar wastes. The pulk is an ungainly, wilful and overweight travelling companion, not much given to conversation."*

While the pulk may be a bit ungainly, it is a godsend to those who are accustomed to hauling gear on their back. Eskimos and Laplanders have been using sledges and pulks for centuries. Western explorers first used small life boats as sledges but those who were successful soon adapted their methods to those of the native peoples. Sledges are a major component in the literature relating to the polar exploration. This picture captures the



Mawson returns to Coronation Bay

Photo of Mawson's actual sledge.

end of Mawson's epic solo traverse from the 1912-13 Australian Antarctic Expedition.

In addition to use by native populations and polar exploration, pulks became important

equipment for military mountain outfits which used them to carry loads of ammunition, food and gear across frozen terrain where vehicles were not practical. The US military still makes a pulk which they call LETRS (Large Emergency Transport and Rescue Sled). The original design was controlled by two skiers- One pulled with a rope harness while the second skier kept the load off the first skier's tail with a set of back ropes. (Some of the older rope harness model pulks can occasionally be found in surplus stores, and they make excellent inexpensive sleds for pulk systems.)

Present companies making pulks for polar exploration and adventure utilize very hi-tech designs. There are several excellent companies, but those that receive rave reviews are: Wilderness Engineering™ from Utah, USA, Fjellpulken™ from Norway and Swowsled LTD™ from the UK. As more and more of us seek to emulate the deeds of famous explorers in more accessible locations like the US Boundary Waters and Canada's Quetico or the 10th Mountain Hut system of the Colorado Rockies, most of us look for inexpensive homemade versions of ski pulks that will not cost an arm and leg; yet will offer much of the functionality of those models used by the explorers. By imitating the features of expedition equipment with less expensive alternatives, it is possible to build a pulk that will meet your needs and still fit in a budget.

As my explorations changed with a growing family and urban responsibilities, I became focused on trying to build a pulk that everyone would use in their 'neighborhood wilderness' and trails. This book chronicles the development of homemade ski pulks from the simplest that I have often seen used on nearby ice fishing lakes through the more complex systems that more closely offer the functionality of commercial pulks. Each pulk will be described in terms of materials, costs, assembly time and pros and cons.

In working with my group of friends from a local ski club, we have made many mistakes in over 10 years of design, production and rigorous testing. I provide this booklet to you so you will be able to learn from our mistakes and find the design that best suits your needs and pocket book.

Note: Internet searches will find many references to pulks used in a popular form of racing that uses dogs to pull the sled and skier. (North American Skijoring & Ski Pulk Assoc.)

Chapter 2. Choosing a sled.

This is perhaps the easiest area to reduce initial outlay of cost, but it also can be one of the most important. Inexpensive kid's pull sleds are made of very thin poly and will flex or crack in all but the lightest of uses. They will work OK for a few uses but people who intend to use their pulk year after year will need better.

On the other end of durability, you have the black rubber cargo sleds that are often used as part of ice fishing shelters or pulled behind snowmobiles. While these are extremely rugged, only the smallest will have application as a pulk since they are heavy and do not slide as well as polyethylene.

The best inexpensive pulk sled that I have found to date is the Expedition Sled made by Paris Company™ of Maine. (see Appendix) This sled has been sold in my local area by Menards™, Gander Mountain™, and Dunham Sports™. Each year it seems that some stores add it and others discontinue it. It retails for around $25-29 but if you want to work with a few buddies, you can order it directly from Paris Company. (They require an order of 6 at a time.) Listed below is the description from the Paris Catalog:

Expedition Sled - 60"x26"x6" shipped by common carrier.
The Expedition sled is manufactured of .125" thick, low drag resistance polyethylene. Color is International Orange for high visibility in "whiteout" conditions. An ideal cache sled. Tow-rope holes are reinforced with grommets. Twelve additional predrilled holes for securing equipment. Excellent tracking properties due to long built-in runners. Counter angled coamings with molded-in handles provide excellent rigidity in a lightweight work sled. POP label includes lacing instructions.

A testimony to this sled comes from the annual candlelight ski I organized for years at a local county park. A pulk made with a Paris™ sled was used for most tasks from carrying luminaire bags to Coleman™ lanterns. Before the lantern crew got started, I would fill and light all the lanterns indoors. I created a zig zag design with bungee chords to keep the lanterns in their place and keep them from sliding around. Once all the lanterns were loaded, we would take them out to the intersections. On one particularly cold day (-20F), we loaded the sled indoors to reduce the time outdoors without mittens. Before the last lantern was in the pulk it got so hot that the polyethylene began to soften up and give in to the tension from the bungee chords making it look more like a canoe than a pulk. A quick trip outdoors and removal of the bungee tension quickly fixed the problem and that particular pulk was no worse for the wear and in

fact, made several more trips over the next years.

The same pulk was used as a high speed luge after it had hauled a load to one of the most difficult of the Colorado 10th Mountain System Huts. Snowbound travelers had created a twisty luge run with a 150 foot drop. Before long, all the hut inhabitants were giving up their plastic sheets and snow shovel sleds and waiting in line for the Paris™ Expedition sled. Only after 25 hilarious luge runs by skiers wearing heavy plastic mountaineering boots did the first breakdown appear. The heavy plastic boots repetitively being jammed onto the plastic by wipeouts eventually created a 3 inch crack in the plastic. In spite of the crack, the sled has continued to serve without problems for several years since.


Rob Rubendall on luge run.

I have tried other toboggan type heavy duty poly sleds that also work well, but it is a little harder to attach your poles to those without a wide coaming (rim). I have also used the harness system described later to attach to old fashion wooden "kinder sleds " that have curved hardwood runners and steam bent rails to provide great seating for kids. These sleds will work well if you haul kids rather than gear, but they are substantially more expensive.

In my last chapter I will talk about the process of custom building a sled to your particular use, using techniques employed for years by boat builders. (Stitch and glue plywood systems) This offers economy, performance with outstanding flexibility of design, but for those looking for occasional use, it is hard to defend the investment of time.

There are three simple design changes that have added some greater utility to my Expedition sled. In situations where you are often on hard packed icy terrain with sidehills, the Expedition runners are not enough to keep the sled from sliding downhill or trying to do an end run around the skier when they come to a fast stop. This is easily cured by attaching 1 or

2 fins to the bottom of your sled. The fins are quickly made from sawing or grinding off a triangular piece of aluminum from 90 degree angle stock. (I used 1 1/2" angle stock about 5" long for icey conditions , but 1" stock would also work if your conditions are less icey.) The fin can be drilled and pop riveted to the bottom.

This cures the tracking problem in icy condition and it handsomely improves the performance of the sled as a luge. It does, however, increase the friction substantially as you pull. An option to reduce friction for your uphill trip but increase control for the downhill is to install the fins inside the pulk with sloted bolts and wing nuts or thumb nuts. When you need them - reinstall them on the outside of the sled.

I have also created ski setting forms similar to what you see on commercial track setters and attached these aproximately 8 inches apart to the bottom of my Paris™ sled which when weighted, becomes a human pulled ski trail groomer. After grooming the trail, wait a couple hours to let the snow set.

To secure the load, a large tarp (that is later used in camp) is placed over the pulk. All the gear is placed on top of the tarp inside the pulk. Then using a *burrito* tuck you wrap the contents by folding the tarp over the load. You can secure your load with a zig-zag of rope but it requires removal of mittens as you work to secure the load through small holes and to tie knots. Bungee chords also work but often you do not have quite the right length and either have to put too much tension on or too little.

The slots shown above create a solution by utilizing a 18 foot 1/4" shock chord. The special slots (created with a drill and hacksaw) will allow you to continue the zigzag process without ever having to remove your mittens. If you prefer a more secure load you can use the holes provided on the Paris sled to secure 4- 5 ft. sections of 1"

flat webbing with 1" double sided travato buckles. (See photo right.)


Back of sled - Note threading of straps.

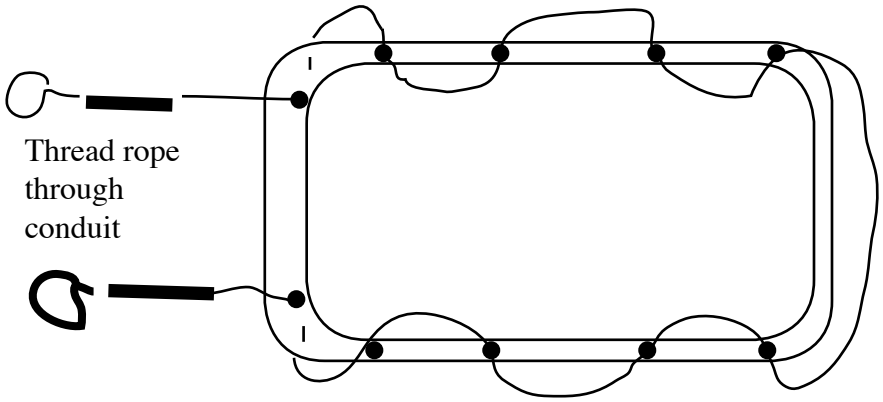
One last caveat – no matter what sled or design you use – **ALWAYS** pack your load with the heavy items to the bottom and lighter on top. A top-heavy load is a sure way to tip over at the first major bump in your downhill travel.

2006 Update:
If you can not find the Expedition sled locally you have a couple different options. I have worked with several customers to use either the Jet Sled Junior or the EMSCO Beast sled as an alernative. Each has their pluses and minuses but they will work. If you do not have the Expedition sled for sale locally but have an REI close by; you also can order it from REI mail order and then have it shiped for free to your local REI. The most amazing part of this deal is that they have the sled priced very inexpensively.

Chapter 3. The Simple Pipe Pulk

Cost for parts*:....$20-30*
Time:**.....***15 minutes***
Pros: *.....Inexpensive and easy to build. Easy to adapt to any sled.*
Cons: *.....Very little control in anything but very flat terrain*
Suggested uses: *Single use situation where the trail will be very, very flat such as ice fishing.*

This is the first pulk that almost all home builders start with. The idea is to prevent the pulk from sliding into your back with the 6 foot conduit poles. The system for keeping the sled off your back is what differentiates a pulk from a sled. Because each pipe works independently of the other, there is very little control – making this system useless for all but the flattest terrain. You can use either metal or plastic conduit. The plastic will break if you fall and the metal will hurt if you fall on it.



Threading technique to distribute stress off pull points.

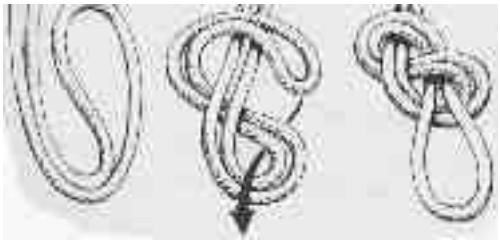


Figure 8 on a "bite" of rope.

Materials:
1. Any sturdy sled
2. A 25-30 ft. section of light rope
3. Waist belt from a large backpack or less expensive versions from Chapter 12.
4. two-6 ft sections of conduit
5. two carabiners or snap links/quick links

Assembly:
Even in this simple design it is important to:
1. Use one piece of rope that weaves around the whole perimeter of your sled so that you are pulling on the entire coaming (edge) of the sled rather than just the tow points (see diagram on previous page).
2. The other important thing to remember is to tie large knots after the rope exits the tow points so the rope cannot slip back through the tow point. This keeps the rope from sliding around the whole assembly after it is threaded. Once the rope is threaded through the pipe, you also tie a loop on the outside using a figure 8 or simple overhand on a bite (loop).
3. These end loops are clipped into a waist harness (Chapter 12) to finish the pulk.

Chapter 4. The U-shaped Conduit Pulk

Cost for parts: *$30-40*
Time: *1 hour*
Pros: *Inexpensive and easy to build. Easy to adapt to any sled. Great for snowshoes*
Cons: *Limited control with rope version. (Good control with improved -hinged version.) PVC conduit will break if too much twisting. Steel conduit will not break but can hurt you if you fall on it. Pole bends are hard to repair.*
Poor tracking due to straight poles.
Suggested uses: *Easy terrain. You do not want to be in terrain difficult enough to cause a fall.*

Different variations of this pulk are the most common home made pulks you will see. The structural rigidity of the cross member at the tow point of the pulk adds significant control. Due to the torque put on the fittings as you move, PVC conduit is not recommended even though it is easier to assemble. The assembly still uses the same tow rope system found in the simple pulk so you use 'pull through' el-

bows with screw off plates rather than standard elbows to create the cross piece. Reinforce the joint with good glue or wrap it in duct tape. Improved versions use metal bolts to hinge poles rather than rope.

Materials:

1. Any sturdy sled & a 25-30 ft section of light rope
2. Waist belt from a large backpack or less expensive versions from Chapter 12.
3. two-6 ft sections of conduit, a 3 ft section of same conduit
4. two - 'pull through' 90 degree elbow joints for this conduit
5. two carabiners or snap links /quick links

Assembly: 1. Cut two pieces of 6 foot metal conduit, and a third piece the width of the sled between tow points.

2. Attach 'pull through' 90 degree elbow joints at the end of both 6' pipes.
3. Attach the small piece of conduit as the cross piece between the elbows.
4. Run the one piece tow rope through the sled as in the Simple Pipe Pulk.
5. Tie large knots in the tow line after it exits the tow point. (Large enough that the rope can not be pulled back through the tow point.)
6. Thread the rope ends through the conduit.
7. After the rope leaves the conduit, tie an overhand or figure 8 knot as close as possible to use as the connection point for the waist harness (Chapter 12).
8. Use carabiners or snap link to secure the waist harness to the rope loop.

The Beast sled is avaialble from Ace Hardware Stores
Part #8092065

Improved - U-Shaped Conduit Pulk

To improve control of your metal conduit pulk ad a rigid hinge to the pole system at the front corners of the sled. (The next chapter shows an example of this with Ubolts and strapping plates. Pictures at right use an eye bolt.) This improvement will give excellent control except for tight turns around obstructions. The poles can attach to the hip belt with either the rope system discussed earlier or by flattening the conduit on the belt end, and drilling it out for a bolt attachment or mini beaner. These pictures of an improved U-Conduit Pulk called "the Beast" from Paul Croteau use eye bolts and bent conduit.

Web Resources for excellent U -Shaped Conduit Pulks

While I moved on from conduit puks to more flexible designs- several others have worked to perfect conduit pulks beyond what I have describved here. There desgns

are availble on the net.
Check out: http://picearubens.tripod.com/pulks.htm and
http://www.telemarktips.com/sled.html

Chapter 5. The Zinszard- *PVC*

Cost for parts: *$40-50*
Time: *2 1/2 hours*
Pros: *Relatively inexpensive and easy to build. Offers excellent control. Can be taken apart for easy transport in car.*
Cons: *The pole system in this sled WILL break if you fall.*
Suggested uses: *Any terrain you are confident you will not fall on.*

Set mending plates on sled to mark holes for drilling.

The name comes from the creators. Steve **Zins**li and Ed Bouff**ard.** This sled is the first prototype developed by the author, and we did sell two or three in the early 90s. Our feeling was that we wanted the pulk poles to break in a fall rather than the skier's bones. We were both good hill skiers, and we simply did not plan to use it on trails we could not handle. Soon after creation, a couple pulks were rented by the author's outdoor center at St. Cloud State University. After the first group came back with a complaint that it broke when they fell, we knew the design would not work for the general public. The pulk can be built relatively inexpensively and it offers excellent control. We used these pulks for several years until we discovered the fiber rods poles that led to a better generation of pulks.


This photo shows a field fixable weak link using hose and wood dowel- It did not work!

The design premise of the Zinszard is to create more control by using a complete PVC pipe rectangular tow bar and metal u-joints for a hinge. By using screw off extensions to create the 6 foot length, we were able to easily transport the pulk as the PVC rectangle tow assembly simply folded back on the sled. I highly recommend use of the Expedition sled due to its flat coamings to attach the U-Bolts.

Materials:

1. A very sturdy sled with flat coamings
2. 18 ft of 3/4" PVC pipe & appropiate primer and glue
3. Four 3/4" PVC T-fittings, two 90 degree elbow fittings
4. Two 3/4" threaded PVC male fittings and two threaded female fittings
5. Two carabiner snap links/quick links
6. Waist belt from large backpack or inexpensive versions from Chapter 12
7. Two 8" mend plates with predrilled holes.
8. Two 1/4 or 3/8" threaded eyebolts with nylon insert self locking nuts.
9. Two 3/8" U bolts (Note ID must be wide enough for the 3/4" PVC pipe.)
10. Four regular 3/8" nuts and 4 nylon insert locking nuts.
11. Two strapping plates for U- Bolts
12. 4 five foot 1" flat straps and 4 dual slide 1 inch buckles for Decure Stap system.

Assembly:

1. Use two 90 degree elbows and two T-joints with 2 PVC sections 5' long and two sections as wide as the sled to create a flat PVC rectangle using appropriate primers & glue.
2. Use 4 inch PVC pipe pieces to extend the pipe out the other end of the T-joints.
3. Glue threaded female fittings on the short pipe pieces.
4. Glue threaded male fittings on the 2 foot pipes.
5. Glue T-joints on the end of 2 foot pipe sections.
6. Cut the ends off two T-joints to create an attachment point.
7. Place the PVC square over the tow points at the front of the sled and use the U-joint to mark where you will need to drill holes to attach the U-bolt to the sled.
8. Make sure that the holes in the metal mend plates match the U-joint. If they do not, use a pliers and vise to make the spacing of the U-joint more or less till it fits perfectly in the holes. Screw a non locking nut onto both ends of the U-bolt until they can go no higher.
9. Place the mend plate over your earlier marks on the sled and mark the precise hole locations. Note that the angle will have to be just right for the metal mend plates to not protrude past the coaming, yet still have the right angle to allow the pipe to swivel. After marking the holes, assemble the unit to confirm the location before actually drilling.
10. Adjust marks as needed, then drill the holes through the sled with a 3/8 inch bit.
11. Place the U-bolt over the PVC pipe; then slide small strap plate on against the nuts you screwed on earlier. Push the ends of the U-bolt through the sled, then put a mend plate below the sled to finish a metal sandwich that compressed plastic to prevent stress point breakage.
12. Screw plastic insert self locking nuts on the bottom of the bolts and tighten.
13. Do the same on the other tow point.
14. To create more attachment points, use 9/16 " eye bolts, self locking nuts and fender washers to create attachment points around the rest of the sled.

Chapter 6. The Perfect Pole Quest....

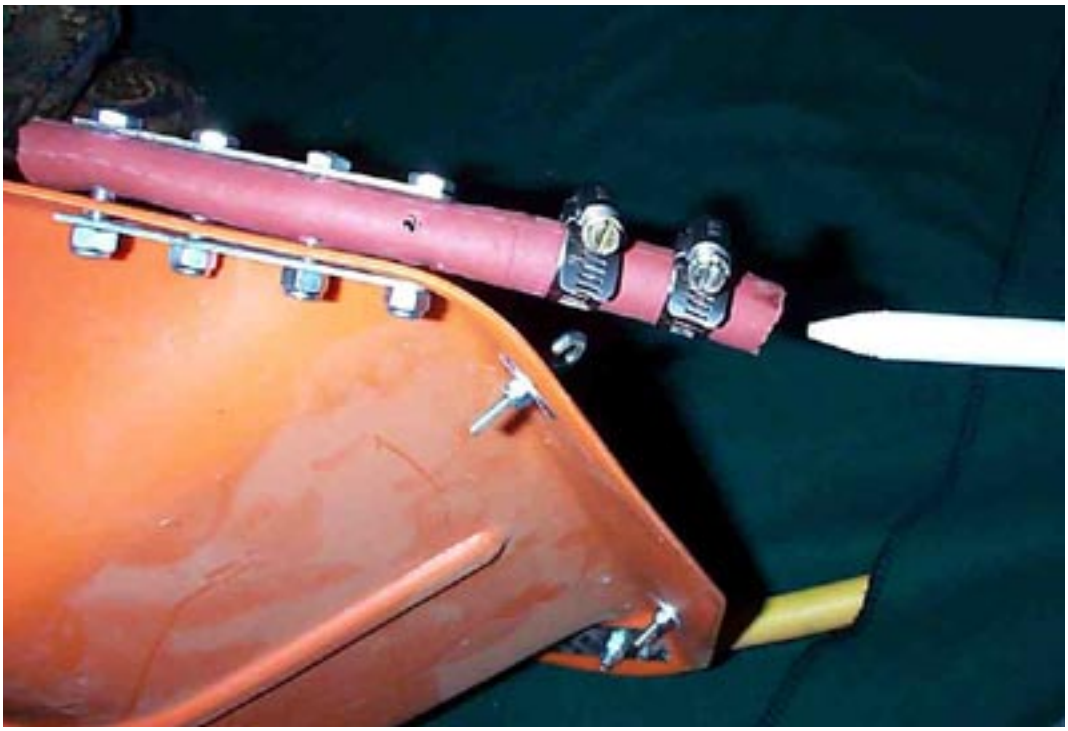
It was during a trip to a ski-in cabin at Minnesota's Tetagouche State Park that our group dreamed up a new pole system. We knew we needed a flexible, yet strong, pole that would bend like a soccer goal line marker yet be strong enough to keep the load off the skier's back. Discussions on fiberglass wands led John Hooper (a Yak rancher) to suggest the use of fiberglass electric fence poles that are made for large animals like elk. Upon our return we experimented with different thicknesses until discovering that the 1/2" solid fiberglass pole was the perfect answer. It flexes several inches in a 6 foot length to reduce potential for injuries during a fall yet they are nearly impossible to break through normal use and are stiff enough to control a loaded pulk behind you on the steepest hill. The next problem was to determine how to attach these poles to the pulk. The MN Ski Pulk I was the first attempt to do this and it is still the least expensive and simplest solution.

Chapter 7. The MN Ski Pulk I

(rubber hinge and fiber rod poles)

*******A BEST BUY********

Cost for parts: *$40-50*
Time: *2 1/2 hours*
Pros: *This system sacrifices a little control, but incorporates fiber rod poles that will bend over a 6 foot length but not break.*
Cons: *The rubber hinge will not last more than a week of rugged use and would be time consuming to repair in the field. You need to screw and unscrew the hose clamps whenever you want to transport the pulk in the trunk of a car.*
Suggested uses: *Any terrain other than significant sidehill.*



This is a great inexpensive pulk. It is easy to build and will serve the needs of most recreational users. This design uses a short piece of rubber hose to create a flexible joint to attach the fiberglass pole to the sled. (High quality rubber or urethane will last longer.)

I again highly recommend the use of either a Paris™ Expedition sled or a sled with flat wood-

en tow points in order to secure rubber hose to the sled.

Materials:

1. a very sturdy sled with flat coamings (i.e. Paris™ Expedition)
2. two feet of 1/2" I.D. (internal diameter) durable hose (use the best quality you can find)
3. two 1/2 " -6 foot fiber rod fence poles
4. two 3/8" copper T-fittings
5. two snap links/quick links (small enough to go through copper fitting)
6. waist belt from large backpack or inexpensive versions from Chapter 12
7. four 4" mend plates with pre-drilled holes
8. eight 1-1/2" long 1/4 inch hex bolts with nylon insert self locking nuts
9. four hose clamps for 1/2"-I.D. hoses
10. eight 9/16" threaded eye bolt (for attachment points to pulk)
11. sixteen 9/16" or 1/4" fender washers and nylon insert locking nuts
12. 10-3003 epoxy hardener & resin

Assembly:

1. Cut two 8-10" sections of 1/2 inch I.D. rubber hose.
2. Sandwich this hose between two steel mend plates near the tow point of the pulk.
3. Drill through the holes of the plates, the hose and the sled. (using a clamp on the middle of the assembly makes this easier. Drill the ends holes first and bolt them. Then remove the clamp to drill the inside bolt holes.)
4. Squeeze the hose between the plates with the bolts to create a wide sandwich that will prevent point breakage.
5. Do the same thing at the other tow point.
6. Cut off the end of two 3/8 inch copper T-fittings. Glue this on the square end of the 1/2 inch fiberglass fence pole using 10-3003 epoxy. This becomes the attachment point for a small snap link or chain quick link that will attach to the waist harness (Chapter 12).

Note on adhesives:

The first prototype of this pulk handled several days on the North Arm Trails of the Boundary Waters near Camp DuNord. After a bad fall we did experience a glue failure of the 5 minute epoxy I had used. Extensive research into glues led to an epoxy

that was specially created to withstand the extremes of heat and cold from space and reentry of the space shuttle. It is a derivative of the glue used to hold the shuttle's heat reflecting tiles. Since I started to use the 10-3003 epoxy, there has only been one glue failure and that was when a buddy ran a pole into a tree so hard that the copper fitting deformed and allowed the glue to break loose.

When using this epoxy, it is important to always clean both the pole and fitting with alcohol before using the epoxy and assembling.

Chapter 8. The MN Ski Pulk II

(rubber hinge and fiber rod poles with easy disassembly)

Cost for parts: *$50-60*
Time: *3 hours*
Pros: *This is essentially the same system as the Minnesota I with the addition of a special hose designed for extended use. It also adds fittings that allow the pulk to be easily assembled without any tools.*
Cons: *This rubber hinge will last through months of rugged use, but it will eventually wear out and it would be time consuming to repair in the field. The copper fitting is a soft metal and will deform if hit hard enough. Once deformed the glue will let go. The rubber hinges are not stiff enough to prevent some slippage when traversing steep side hills.*

Suggested uses: *Any terrain other than significant sidehill.*

After a particularly gnarly fall using a new pulk I noticed a premature tear in the stan-

dard auto store hose. That led me to seek out a better hose to use as the rubber hinge. I found the right product in the Terminator hose from American Hose & Fittings Inc.™ I also discovered that the pole needed glycerin of a soapy water film to be inserted into the hose and it became so tight that a hose clamp was not necessary. Of course, to dissemble the pulk for easy transport in a car trunk, I needed to find a way to disassemble the poles. This was done by using male and female copper 3/8 inch threaded pipe fittings.

I again highly recommend the use of either a Paris™ Expedition sled or a sled with flat wooden tow points in order to secure rubber hose to the sled.

Materials:

1. A very sturdy sled with flat coamings (i.e. Paris™ Expedition)
2. two feet of Terminator 1/2" I.D. (internal diameter) hose
3. two 1/2' 6 foot fiber rod fence poles and 2 short spare 6" pieces of pole
4. two 3/8" copper T-fittings
5. two 3/8" copper threaded female fittigs and 2 male fittings
6. two snap links/quick links (small enough to go through copper fitting)
7. waist belt from large backpack or inexpensive versions from Chapter 12
8. four 4" mend plates with predrilled holes
9. eight 1- 1/2" long 1/4 inch hex bolts with nylon insert self locking nuts
10. eight 9/16" threaded eye bolt (for attachment points to pulk)
11. sixteen 9/16" or 1/4" fender washers and nylon insert locking nuts
12. 10-3003 epoxy hardener & resin

Assembly:

1. Cut two sections of 1/2 inch ID terminator hose.
2. Using a spare pole, cut off 6" to 12" sections that will be pole extenders.
3. Using glycerin or soapy film, coat one end of these short extensions and shove them into the terminator hose 3-4"
4. Epoxy a female copper fitting on the other end of these fiber rod extensions (use 10-3303 epoxy).
5. Sandwich the hose between two zinc mend plates near the tow point of the pulk.
6. Drill through the holes of the plates, the hose and the sled. (using a clamp on the middle of the assembly makes this easier. Drill the ends holes first and bolt them. Then remove the clamp to drill the inside bolt holes.)
7. Squeeze the hose between the plates with the bolts to create a wide sandwich that will prevent point breakage.
8. Do the same thing at the other tow point.
9. Cut off the end of two 3/8 inch copper T-fittings. Epoxy this on the square end of the 1/2 inch fiberglass fence pole using 10-3003 epoxy. This becomes the attachment point for a small snap link or chain quick link that will attach to the waist harness (Chapter 12).

10. Cut off the pointed other end of the pole and epoxy a male copper fitting on those ends.
11. Use 9-16" eye bolts, self locking nuts and two fender washer to create attachment points around the rest of the sled.

Chapter 9. The MN Ski Pulk III

(metal hinges and fiber rod poles with threaded ends)

Cost for parts: *$50-60*
Time: *3-4 hours after creating assembly jig - (special bolt threader needed.)*
Pros: *This design eliminates most of the problems with the earlier system. It has excellent control and utilizes zinc coated steel fittings that are both epoxied and threaded for double adhesion. These fittings have been tested to -20F and with pulls of up to a thousand pounds without failure. It utilizes an intentional weak link (metal eye bolt). The eye bolt is very easy to replace in the field.*
Cons: *The metal linkage prevents catastrophic breakdown but it also sacrifices a little control. The metal linkage also creates an annoying little rattle. Threaded poles require extensively more time to set up the jigs and assembly to thread the poles. (If the builder prefers to eliminate the "weak" link; they should use a forged 1/4' eye bolt instead of a bent one. It is more expensive but it is also much stronger)*
Suggested uses: *Any terrain except significant sidehill. Very durable for extended use.*

This was the first design that I put produced in any number. Several were sold across the country. When assembly became more work than fun, production was stopped and this book was written to *pass the word*. I continued to make a few new innovations and subsequent new generation pulks for friends and I also sell a few new pulks to help pay for this web site. Since the process of creating the special threaded metal fitted poles requires special tools and jigs, I have continued to create and sell these poles to builders who do not want to go through the hassle on their own. Info is listed in the resource section.

In this upgrade the rubber hinge is replaced with a small steel U-bolt with a 1/4 inch eyebolt threaded on it. Use of special reducing fittings allows the 1/2" fiberglass rod to be threaded with metal to metal connections that do not wear out quickly. The steel is much more durable.

Materials:
1. A very sturdy sled with flat coamings

(i.e. Paris™ Expedition)

2. four 1/2″-13 to 1/4″-20 reducing couplers
3. two 1/2″ -6 foot fiber rod fence poles
4. four 1/4″ steel threaded eye bolts (locktite needed for 2 of these)
5. two snap links or quick links
6. waist belt from large backpack or inexpensive versions from Chapter 12
7. two 4″ mend plates with predrilled holes
8. two 3/4″ long 1/4″ bolts with nylon insert self locking nuts
9. two 1/4 X 1 1/4″ U-bolts with nuts
10. two 1 1/2 inch strap plates and four 1/4″ nylon insert self locking nuts
11. eight 9/16″ threaded eye bolt (for attachments points to pulk)
12. sixteen 9/16″ or 1/4″ fender washers and nylon insert locking nuts
13. 10-3003 epoxy hardener & resin

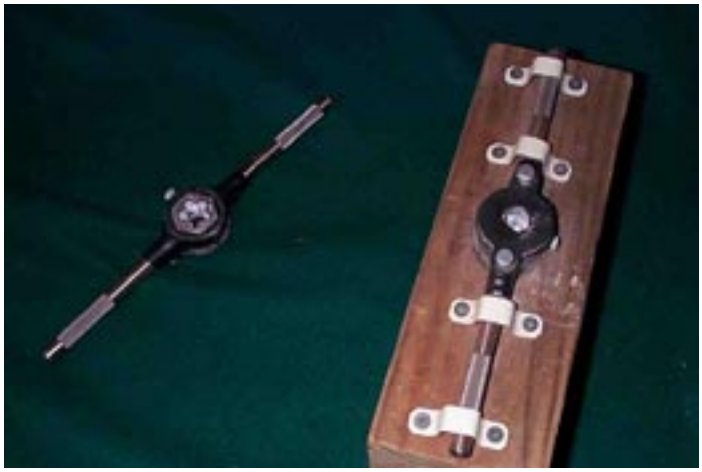


Photo of rod threader and rod threader mounted on 4x4 for straight alignment.
This cutter is used on next 3 versions.

Assembly:

While the sled and poles are the same as in previous versions, the attachment system is entirely different.

1. Assemble a jig (see photo on previos page) to hold the poles tightly for threading. (Use inner tube to keep from marring the poles in the clamp.)
2. Mount rod threader on 4x4 with 9/16″ hole drilled in it to assure that your threads will go on the rod straight. Note I tried several cutters with poor results before I tried the die set from Northern States Supply that works well. I used the cutter mounted on the block to start the threads 2-3 turns (to assure that the threads go on straight) - then switch to the thread cutter not attached to block.
3. Thread just enough of the rod to insert 1/2 way into the coupler.
4. Clean both the rod end & coupler, then epoxy coupler to rod end with 10-3003 epoxy.

5. Do the same for the other end and then the other pole.
6. Drill holes in the sled to accommodate the U-bolt and the last hole on the mending plate that goes below the plastic coaming. (Make sure the holes in the mend polate lign-up with the Ubolts ends. If not spread or pinch U-bolt width to fit or drill new hole in mend plate.)
7. Thread two non locking nuts on the U-bolt all the way.
8. Put a 1/4 inch threaded eye bolt on the U-bolt then cover with strap plate. Insert it in the sled then cover the bottom with the mending plate and locking nuts. Locktite nuts for extra safety.
9. Use a fender washer on the end bolt before it goes through the sled and mending plate, use locking nut.
10. The poles attach to the sled by 1/4" eye bolt.
11. For harness end of pole, cut 1/4" eye bolt shank after about 6 threads so it is shorter. Locktite this bolt.

(Note: 1. To quiet the annoying rattle of the linkage. thread a piece of vinyl tubing over the U-bolt before assembly.
2. Pictures show inexpensive steel wire eyebolts. Strength is greatly improved by using more costly forged eyebolts.)

Chapter 10. The MN Ski Pulk IV

(Ball Joint hinges and threaded fiber rods)

Cost for parts: *$70-90*
Time: *3-4 hours after creating assembly jig - (special die cutter needed.)*
Pros: *An excellent homemade design. The ball joint system allows superb control and the fittings are so oversized for typical use that a weak link for planned failure was not needed.*
Cons: *Weight of oversized balljoints and threaded bar, welding required.*
Suggested uses: *Any terrain. Any use.*

Materials:

1. A very sturdy sled with flat coamings (i.e. Paris™ Expedition)
2. two 1/2"-13 to 1/4"-20 steel reducing couplers
3. two 1/2"-13 to 1/2"-13 steel couplers
4. two ball joints with 1/2" 13 coarse thread (must be custom made)
5. two 1/2" 6 foot fiber rod fence poles
6. two 1/4" threaded forged eye bolts (with locktite) (see instruction for MN III)
7. two snap links or quick links
8. Waist belt from large

backpack or inexpensive versions from Chapter 12

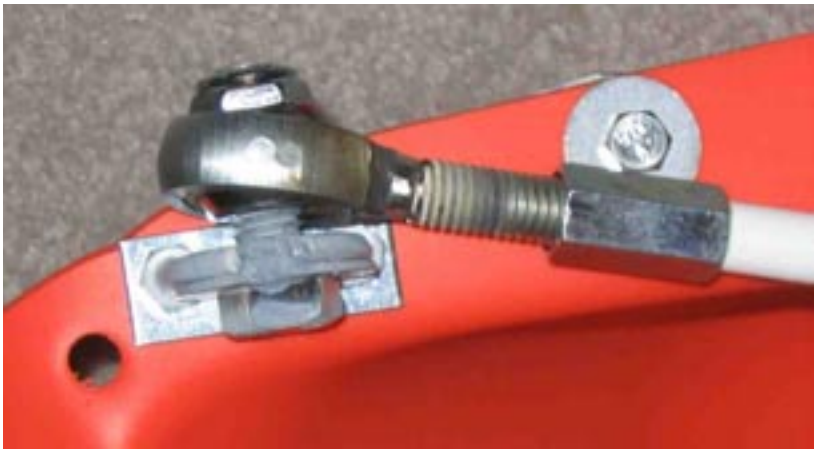
9. two 4" zinc mend plates with predrilled holes
10. two 3/4" long 1/4" bolts with nylon insert self locking nuts
11. two 1/4 X 1 1/4" U-bolts with nuts
12. two 1 1/2 inch strap plates and four 1/4" nylon insert self locking nuts
13. one 1/2" by 30" threaded metal rod with two nylon insert locking 1/2" nuts
14. eight 9/16" threaded eye bolt (for attachment points to pulk)
15. sixteen 9/16" or 1/4" fender washers and nylon insert locking nuts
16. 10-3003 epoxy hardener & resin

Assembly:

The process of building a jig to thread the poles is exactly the same as in the MN Ski pulk

1. Thread fiber rods and epoxy zinc coated steel couplers as in the MN IV Ski Pulk. The only difference is that in this design you use a reducing coupler at one end, and a 1/2"-13 to 1/2"-13 straight coupler on the other.
2. Take your ball joint rod ends to a machine shop to have 2 inches of 1/2"-13 coarse threaded rod welded to the end. (Balljoints all come with fine thread)
3. Place the long threaded rod over the front of the sled and mark where the U-Bolt holes will need to go. I usually have the bolt point a little to the front inside to create a natural crossing of the poles, when they are attached later. This also helps create a smaller diameter hole for the threaded stock to further increase control. Drill holes in the sled to accommodate the U-bolt and the last hole on the mending plate that goes below the plastic coaming. (Make sure the holes in the mend polate lign-up with the Ubolts ends. If not - spread or pinch U-bolt width to fit or drill new hole in mend plate.)
4. Thread two non locking nuts on the U-bolt as far as they will go, then cover with strap plate. Insert it in the sled, then cover the bottom with the mending plate attaching the locking nuts. Use loctite for extra safety.
5. Use a fender washer on the end bolt before it goes through the sled and mending plate, securing with another locking nut. Repeat this for the other side.
6. Push the threaded stock through both eye bolts and put on the ball joints and approximate how much rod will extend beyond the nylon lock nuts. You do not want any threaded rod extending beyond the nuts as it could cut someone. Saw off the excess threaded stock. Locktite the 1/2" nylon insert nuts as well for extra safety.
7. Push the threaded rod through U-bolts again and attach Heim rod ends and nylon locking nuts. By tightening the nuts you can control how much flexibility the pole assembly has.
8. For harness end of pole, cut 1/4" eye bolt shank after about 6 threads so it is shorter. Locktite this bolt permanently.
9. Poles assemble by threading the end of the 'rod end'

into the steel coupler.



ALTERNATE ATTACHMENT DESIGN

Since this design already requires a visit to a welder to create the coarse thread ball joints, I decided tp try an alternate design by having the welder weld a 1/2″ coarse thread 1 1/2″ hex bolt to a 1/2″ fender washer and then weld the combined unit to a 1/4″ x 1/3/4″ U-bolt. With this design - you do not need the long length of threaded stock. It is a little less bomb proof for those who envision a fall down a mountain couloir but it creates a lighter sled without any loss of control. I tried it for the first time in 2004-5 and will keep this book posted on the durability of the welds. I have placed the U joint starting with the corner hole provided by Paris and as far back as 3 inches. I have 'toed' the placement angle in a lot and a little. They all work OK depending on the length of your poles but if you use a O ring to connect your poles and want to be able to swing your poles over the pulk when it is sitting idle -without having to disconnect one of the poles I have found the placement angle needs to be pretty parrallel to the pulk. See photo right for most versatile placement.

(2005-6 update: I was able to get some mechanical engineering friends to test component strenghts. Much to my surprise the poor looking threads that resulted from threading the pole with a fine thread (1/2″-24) cutter resulted in a bond as strong as the coarse thread pole even though the coarse threads looked better. I guess this is due to the strength of the 10-3003 epoxy. This means that you can epoxy a female threaded 1/2 ball joint directly on the pole and use a channel/pin design (see Premier Pulk below) or epoxy a fine threaded coupler to the pole in the MN Ski Pulk IV and not have to visit the welder to convert the balljoint to coarse thread.)

Chapter 11. The EWS Premier Pulk- Lightweight Ball-joint Pulk

This design was created to alleviate the need to visit a welder and also to reduce the weight of the pulk attachment system while maintianing the appropriate strength. The inspiration came during the two hour drive to telly ski at Spirit Mountain with a freind and fellow pulker- John Muldowney. John came up with the concept of using aluminum channel and a pin to secure the joint rather than being concerned with our old system of threading the

ball-joint to the poles each time you set it up. We knew that the 1/2" ball joint we previously used were overkill, but the problem was in transfering the rigidity and strength of the 1/2 rod to a smaller diameter ball-joint. We also knew that this design would remove the need to visit a welder and thus be popular with most builders who do not live near neighbors with TIGG welders.

By using a 5/16" ball-joint (It still rates at over 2,000 lbs.) and a custom created reducing coupler, we could keep the ball joint on the pole permanently and use the aluminum channel and pin to remove and attach the poles to the pulk. In the end the final product is strong, maintains excellent control and it even looks professional rather than home made. Best of all the only special tool needed beyond threading the fiberglass rod is an "I "drill bit and 5/16" thread tapper... (which can be obtained anywhere at reasonable costs). This design is so good that we believe it will be the last design we will but together for the pulk poles. (At least this is what I tell my wife.) ***An improved version of this system is the only one being manufactured now by Ed's Winlderness systems. (Some parts are listed in the Resource Section.)***

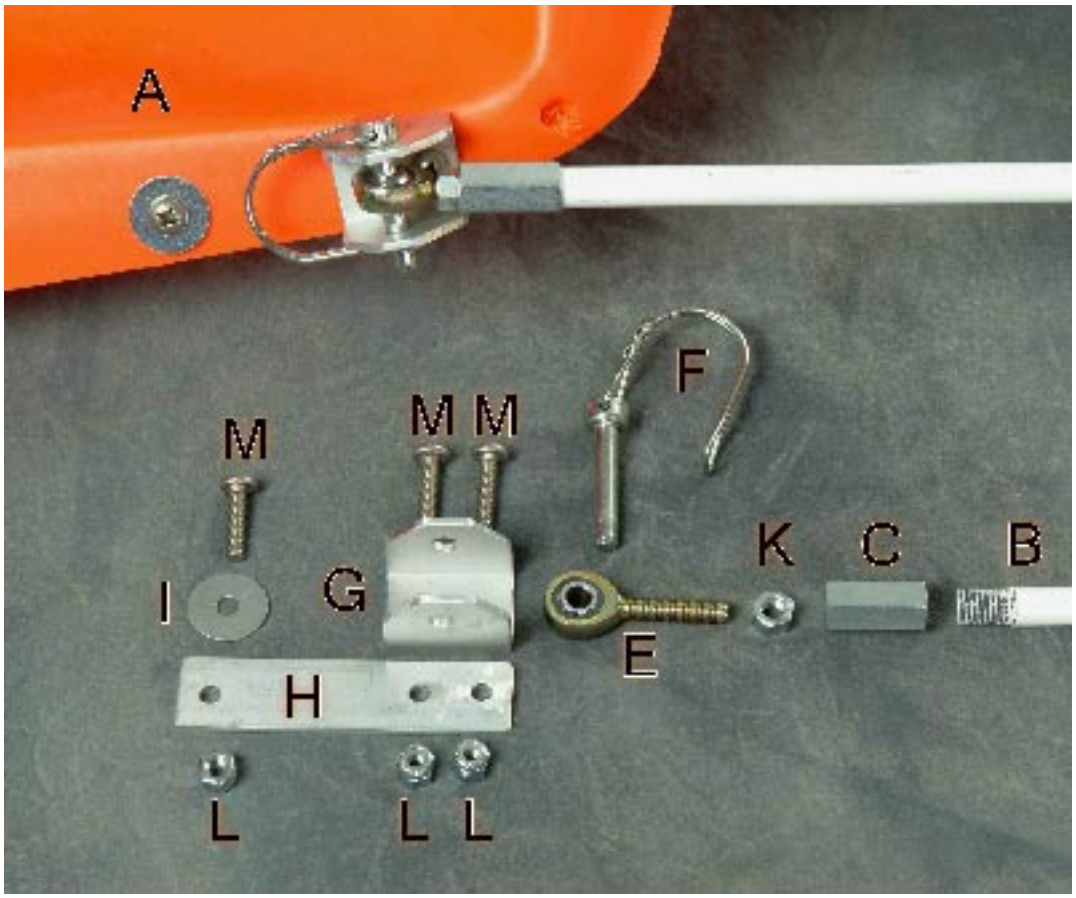
Note- Those desiring the overkill of 1/2" ball joints can still use the channel / pin lock assembly to attach to the the sled. Just press a 1/2" to 5/16" bushing in the ball joint and make sure that the 5/16" hole in the channel is high enough to give proper clearance.

Cost for parts:	*$70-90*
Time:	*3-4 hours after creating assembly jig - (special die cutter and thread tap needed.)*
Pros:	*The best system we have seen that you can make yourself. It provides excellent control and durability and it even looks very professional.*
Cons:	*None*
Suggested uses:	*Any terrain. Any use. (Ad fins for appications with sidehill.)*

Parts Needed – (letter is used to identify part in photos)
(Total costs around $70-80)

a. One 5-foot Paris Expedition Sled (this sled is much thicker and thus more durable than typical kids sleds)
b. Two 6 foot long 1/2" diameter solid fiberglass poles
c. Four 1/2" to 1/4" (coarse thread) reducing couplers
d. Two 1/4" coarse thread forged eyebolts with 1" long shafts
e. Two 5/16" fine thread ball joints
f. Two 5/16" hitch pins with 2" long shaft and retaining clip
g. Two 1-1/2 long sections of 1-1/4" by 1-1/4" aluminum channel (1/8" thick)
h. Two 5" long sections of 1-1/4" wide aluminum flat stock (1/8" thick)
i. Two stainless steel 1/4" fender washers
j. Two 1/4" coarse thread nuts (use as jam nuts)
k. Two 5/16" fine thread nuts (use as jam nuts)
l Six 1/4" coarse thread stainless steel button head bolts 1" long
m. Six 1/4" nylon insert lock nuts
n Two feet of 3/4" nylon flat webbing
o. One back packing waist belt or four feet of 2" wide webbing and three feet of padding material & 2" double ladder lock buckle thick)

p. Two chain quick links or snap links)
q. Four double ladder lock 1” trevato buckles
r. Four sections of 5 foot long 1” webbing
Other items not in photos-
s. Permanent thread sealant (Locktite 262)
t. 50 ml syringe of special 10-3003 epoxy
u. One 9” or 13” 3/4” wide Velcro chord wrap



Tools needed:
Hacksaw
Die stock and 1/2” coarse thread die to thread pole.
Tap wrench with 5/16” fine thread tap and Letter “I” drill bit.
Jig for securing poles when threading them.
Drill with 1/4” and 5/16” drill bits.
Screw driver and socket wrench.
Power grinder or belt sander.
Sewing machine.

Assembly Instruction:
1. Secure the fiberglass pole with a jig.
2. Thread about 8 threads (using 1/2” coarse tap) onto both ends of the poles.
3. Cut off all but 1/2” of the threads on your forged eye bolts. (I use spare nuts to guide the

hacksaw blade and to help clean the thread after the cut.)
4. Cut off all but 1/2" of the ball joint threaded shaft.
5. Using a letter "I" drill bit, prepare two of the reducing couplers to accept the 5/16˜ fine thread ball joints by first drilling through the existing 1/4˜ holes on both coupler, thus enlarging the holes.
6. Tap these holes with a 5/16˜ fine thread tap.
7. Thread a single 5/16˜ jam nut onto each ball joint shaft.
8. Apply Loctite to the threads, then screw the ball joints (with jam nuts in place) into the reducing couplers whose holes you have just rethreaded to 5/16˜. Do not bottom out or tighten the jam nuts at this point.
9. Apply Epoxy to the threads, then screw a coupler/ball joint assembly onto one end of each fiberglass pole until the poles bottom out. Now twist the ball joints in as far as they will go and tighten the jam nuts.
10. Thread a single 1/4¯ jam nut onto each of the forged eyebolts.
11. Apply Loctite to the threads, then screw the forged eyebolts (with jam nuts in place) into the reducing couplers. Do not bottom out or tighten the jam nuts at this point.
12. Apply Epoxy to the threads, then screw a coupler/eyebolt assembly onto each remaining end of the fiberglass poles until the poles bottom out.
13. Twist the eyebolts in as far as they will go, then back them out until the axis of the eyebolt and ball joint on each pole are aligned in the same plane. Now tighten the jam nuts.
14. Use hacksaw or other saw to cut aluminum channel stock to 1-1/2 " length.
15. Use saw to cut aluminum flat stock to 5" lengths.
16. Drill 5/16" hole 3/4" inch from base of channel in the middle of the channel. Drill through both wings of the channel.
17. Drill two 1/4" holes in base of aluminum channel.
18. Line up the channels over the flat stock and drill two holes in flat stock to match the holes in base of channel.
19. Drill 1/4" hole toward the end of the flat stock.
20. Use saw and grinder to create a circular radius on the two wings of your channels.
21. Place the channel over the front coamings (rim) of the Paris sled and drill two 1/4" holes in the sled to match the base of the channel. (note: The channels should be slightly angled inward.)
22. Bolt the channels (Locktite and use nylon locking nuts) on the sled through the flat stock so that it becomes a bottom plate sandwiching the plastic of the sled.
23 Drill through the sled plastic using the remaining 1/4" hole in the bottom plate (flat stock) as a guide.
24. From the top of the sled use a fender washer and bolt with locking nylon nut & Loctite to sandwich the sled plastic between the fender washer and bottom plate.
25. Insert 5/16" hitch pin into channel hole. This is how you will attach and detach your poles.
26. Sew the 3/4" webbing on your waist belt to create tight loops that are about 1-1/4-1 1/2" long. These loops will go through the eye of the eyebolts and you will use you quick links or

snap links to clip the loop and keep the waist belt secured to the poles. 27. Insert the five foot pieces of 1" webbing through the holes on the sled closest to the front and back. Take the webbing back up through the holes closest to the middle and pull till the tails are equal on both ends. Secure these ends to the 1" trevato buckles and do the same thing on the other side of the sled till you have 8 straps coming over the sled that are secured in the middle with the 4 buckles.
28. Attach the poles to the sled and your hip belt to determine where they will cross. Use duct tape to secure the 3/4" wide Velcro strap on one pole where they cross. This allows you to make a Velcro loop that helps keep the sled from turning over. (Note the pulk can be pulled with straight poles or with the poles crossed. By crossing them you greatly improve tracking in heavy forests and reduce running into trees when making turns.)

Chapter 12. The Harness

The best waist harness for pulling a pulk resembles an internal frame backpack support system complete with padded waist and shoulder straps. A good padded replacement expedition backpack waist belt works good enough for most uses, but when pulling a heavy load up

steep inclines, the waist belt will tend to ride down the hips. You can prevent this and add shoulder support by attaching an old day pack to the waist belt with some webbing, bucklers and velcro. the day pack ads the advantage of allowing for a hydration system.

The simplest belt we have designed uses a piece of 2 inch webbing, a 2" Fastex Travato Dual buckle and a two 2" tri-glides. (see photo right) Weave a piece of climbing webbing through the tri-glides to create a loop that can be attached to the poles with a carabiners or quick link.

An improved version is sewn loops to the outside of the 2 inch webbing using 3/4 inch webbing. **At first I would just clip the poles into these loops but I discovered that by sewing the base of the loops close together and making the loops long enough (1.25"- 1.5" with wire steel eyebolts and 1" with forged eyebolts) to thread the eye of the pole with the webbing loop then clipping the loop with the mini beaner on the outside of the eye bolt you keep the pole end closer to the waist.** By reducing the slack you have more control.

Whenever I have visited with customers who express concern on their pulks control, I almost always find this to be one of the areas they have cheated on. Attaching your poles to webbing on a day pack will NOT work well. You need to reduce the play on the harness end of you poles to 1 1/2 inches or less to have excellent control.

Put webbing through eyebolt then secure with clip to reduce free play.

If you can find a replacement backpack belt (I often use the inexpensive Camptrails™ belts.) you can sew loops on to this as well; but you will probably have to have a canvas repair shop sew this for you since the padding requires a heavy duty machine. Another option is to use a lumbar type pack with built in shoulder straps. This allows you to carry your hydration system and hat and gloves while attaching the pulk to the lumbar pack waist strap.

Chapter 13. Skinning & Stream Crossings with Pulks

My only complaint of the MN Ski Pulk IV came up on a particularly difficult section of the 10th Mountain Division trail to Maggie's Hut near Aspen Colorado. In order

to avoid an avalanche valley, the trail switch backs up a particularly steep mountain side for a good mile. On the rest of the trip my colleagues with packs were impressed with the pulk's utility. In particular, whenever we would take a short breather on an uphill, my body would immediately be at rest since there was no load on my back. The backpack skiers would seldom remove their packs since it required extra effort to mount and dismount it while on top of 10 feet of powder.

These hours of advantage gave way to one very difficult disadvantage. When the route became very steep, the weight of the pack on the body helped the climbing skins bite the snow even more. With the 70 lb pulk pulling me downhill and insufficient 'over ski' weight to get enough bite from the climbing skins, I would back slide. *(Part of the problem was the poor inexpensive plastic skins I was using. More on this later.)* I ended up attaching the skis to the pulk and 'post holing' up the steep section. A better solution quickly became apparent. By packing the pulk with a single back pack instead of multiple duffels and packs, it would be feasible to pull the pack off the pulk for this short extreme section and wear it for the extra bite over the skins. Once the trail became more typical, I could put the pack back in the pulk. This same technique applies to stream crossing in areas without snow bridges or frozen sections. The pulk can be attached to the pack as a turtle shell or pulled behind you empty.

Once I acquired some better skins, a second solution became apparent. Since I upgaded to a hip belt with staps to attach to a day pack that allows the shoulders to held pull; I discovered that when encountering a very steep ascent; all I had to do was transfer a bit of the weight from my pulk to the day pack and the skins would let me climb just about any steep pitch.

Chapter 14. Brakes

There are two types of brake systems generally applied to homemade pulks. The simplest is to attach a loop of plastic chain to the front two corners of your pulk. Tie a line to middle of it and run it through a loop on your poles to your waist band. By bringing in the line the chain loop gets suspended over the front of your pulk. When you need to brake just let the line go loose and the chain runs beneath the pulk slowing you down.

The second type is a passive brake. This uses a barn door type hinge on the back of your pulk that simply drags the metal point in the snow but the minute you put any backwards force on the sled - the point drives into the snow providing some breaking.

The fins that we mentioned in the sled section also provide some breaking action for a pulk. If you you could figure out how to make an adjustable fin on both back corners of the pulk, you could make it longer when you needed breaking and shorter

when going uphill. I continue to work on this idea.

Chapter 15 Assembling your Pulk Poles

Most commercial pulks have the poles going straight back from the harness to the sled. *While all of our systems will work that way as well*, I have found that by crossing the poles in the middle between the harness and the sled you create a momentary delay in how the sled follows the skier. This allows you to turn a corner around a tree and not worry that your trailing sled will run into it. It also works well in preventing a turnover to one direction since the bottom pole has to go through the top pole to turn. It will still turn over easy in the other direction so I tape a rubber O-ring or Velcro chord arap formed into a ring to the midpoint then insert the second pole through this ring in order to discourage a turn over in that direction. With the poles crossed and bound in the middle you do run into an issue with folding the poles back over the pulk to make it shorter when you get to your destination or to throw them in back of the van. If you have placed your attachment points to the sled with some "inward" toe angle - the poles will bend when you try to fold them back. The velcro strap eliminates this issue since you just open the ring when you fold the poles back and they fold easily.

Assembly of poles if you use a rubber O-ring:

1. Attach pole with black loop first.
2. Insert second pole through the black loop then attach it to the sled.
3. Make sure the poles are crossed, then attach the waist band with chain links.

Measuring Pole Length-

I generally make my poles 5 feet 11 inches or 6 feet long. This seems to work for most people. We have found that shorter poles do increase control somewhat. The poles needs to be long enough to prevent your skies from hitting the front end of the sled with your skis. The best length is measured from your waist to the tip of your rear ski during a stride (plus 4-8 inches). Those who will snowshoe rather than ski can get by with even shorter poles.

Chapter 16 Customization

The best pulk design for you will be customized for your special needs. Many young parents have decided that their need is to find a way to bring the kids out with them when they head out on the trail. These parents will find a way to add a safety seat to their pulk. (A safety seat is no substitute for smart route selection when hauling kids along.) In fact most of the expedition companies have started building adapter kits to allow their pulks to be converted to child carriers.

Those explorers who intend to head over pack ice have discovered that large pulks that can double as small boats can help save their lives when early spring "open water leads" develop. The photo below shows an ingenious adaptation for someone who often goes into areas where hot spring days will melt much of the snow on the return trip. It is a pulk/cart. The sky is the limit.
Customization rules.

Have fun!

Wilderness Engineering Kinder Shuttle

http://www.permaflate.com/sleduse.htm

The author on way to Continental Divide.

Chapter 17. Resources for Materials

Sleds: (Expedition)
Paris™ Company Inc.
Now part of ERAPRO
2500 Guenette, St. Laurent, Quebec 514-335-0550 or
207-539-8221
Sometimes REI has the sleds at REI.com and will deliver to your local REI store for free.

Poles:
K Fence™ Inc.
1/2" x 6" Sunguard II Fiberrod Post
RR#1 - Box 195, Hwy 60 West
Zumbro Falls, MN 55991 507-753-2943
Assembled poles sold by Ed's Wilderness Systems 320-253-4573

1/2"-13 to 1/4"-20 Reducing couplers, aluminum channel, I drill Bit and 5/16" tapper, safety pins
5/16' ball joints
McMaster-Carr Supply Company™
600 County Line Rd.
Elmhurst , IL 60126-2081 (630) 833-0300
www.mcmaster.com

Special Epoxy 10-3003 Hardener & Resin
Epoxies Etc.™ (ORDER SEMID RIGID IN CLEAR)
21 Starline Way
Cranston, RI 800-376-9437

Hardware: 1/4 Threaded eye bolt, 3/16" quick links, Nylock nuts, 1/4" - 1/1/4" U-bolts, 1 1/2 " strap plates, Fastenal™ Company (local franchises)
Copper 1/2 pipe fittings, galvanized mending plate, threaded rod & 1/2"-10 to 1/2'-10 couplers - Local hardware store

Hose:
1/2 black hose- Local Farm or Auto store
1/2 inch Terminator Hose:
American Hose & Fittings Inc.™
6812 So. 220th St.
Kent WA 98032 800-877-8041

Webbings and buckles:
(Note: 18 foot (double hook) 1/4" shock chord or Four 1" strap system with fastex buckles are available from the author. See next page)
Seattle Fabrics
8702 Aurora Ave. N.
Seattle, WA 98103 206-525-0670

Ball Joints (Sperical HEIM Rod Ends) for hinge:

Part # MBM8 (1/2-20 M 4 PC RE Bronze). Tuthill Corp, National Rod End Division,
615-688-2628 These have fine thread. Cut off fine thread and have machine shop weld 2 inches of coarse threaded rod. (1/2'-13) or thread your pole with fine thread (1/2"-24)

Systems from the author (Eds Wilderness Systems):

My efforts to make an even better design eventually led to having many parts custom machined. I sell completed systems and pole sets but do NOT sell individual parts. While I enjoy helping others with infomration on building their own, I am also running a business and can not make the business successful by selling just parts.

Ed's Wilderness Systems Sales

Pulk Poles /harnesse/ complete systems

(Check web site for most recent prices!)

www.skipulk.com

Ed Boffard
708 S. Park Pl. **Email:**
SKIPULK@YAHOO.COM
St. Cloud, MN 56301 **(320) 253-4573**
(320) 259-9566 (FAX)

Recent reviewers of this wed site have sent in different suggestions:

From Ed Heusser - Use urethane tubing instead of rubber hose for hose hinge pulk.
He ordered from: http://www.freelin-wade.co

From Ralh Oborn - If you get the really cheap decorative chain that is bent into an "8" shape and open up one side of the links you will have a series oflittle hooks and eyes. I thread about 20 of these hooks onto a lengthof parachute cord then use it for the zig zag tie down. The hookscatch the perimeter rope wherever I need it. 20 Kmart and other garden shops have tomato poles for beans, tomatoes and other climbing plants to climb, they are either 5 or 6 foot longwith plastic coated metal. They are flexible enough to land on but rigid enough to transmit the load to the belt when downhilling. I through drill them and clip on with a
ring or small biner.

From Robert Gross - Use Maxiglide to lubricate the bottom of fiberglass pulk sleds.

David Jackupciak writes:
For my final design, I built a cedar strip form that outlined the contour of
> the sled hull. I used that for the form to build a fiberglass hull. The hull bottom is concave, to allow the sled to ride on the edges when on hard snow or ice. These fins also help the sled track straight. I used aluminum poles with ring style snap connections. This made it easy to assemble with gloves. The harness was a lot like your final one, I riveted leather patches to the hips of the nylon webbing for reinforcement.I added 2 folding hoops to the sled, the rear one acted as a back rest for a passenger. Both hoops formed the frame for the optional cover. The hardest part was actually making the cover (mostly because I am pretty inept as a tailor). But my kids had fun riding it in (but now they want to ski) but that only lasted a few years. The whole thing was pretty
inexpensive less than $80 (if you do not count all the cost related to various experimentation).
My latest thought was to use a similar construction technique to build an ultra light pop-up fishing shelter that would function as the sled as well - suitable for pulling while on skis or snowshoes. But I want it to be super easy to put up and down and not have poles to put together. Some thing like those small practice soccer nets that basically twist into an ellipse for storage seem to be a possible approach. Maybe even with a long enough sled you could sleep in it? A portable yurt?

From: Tom Dunlap
My waistbelt was from an external frame pack. To attach the rods to the belt I used some plates from car seatbelts. The plates had a slot in one end and a tab with a hole in it. I can't remember where I scavenged them. I slipped a piece of seat belt webbing in and took it to the shoe shop for sewing. The conduit rods were flattened on one end and drilled for a 3/8" bolt. I used large washers and a Nylock nut to hold the belt to the rods. There is a little pivoting action. With the solid system the pulk moves when I pull. When I stop I don't have that last little bit of movement poking me.

From DBill S: Ed -

From Bill S at Trailspace.com Your pdf does a nice job of putting together many of the ideas posted on this and other sites over the years in one place and with clear illustrations. It does leave out some of the standard practices used, for example, in the Alaska Range (although some of those really don't work very well). One thing left out that would be useful is some more extensive discussion of problems that arise with some of the varieties of sleds and pulling and tiedown arrangements. A lot of these have been discussed on this site, mtncommunity.org, Views From The Top (I forget their URL), and several of the backcountry ski and mountaineering sites. For example, PVC (for poles) tends to become brittle at very low temperatures, such as encountered in the Tetons, Montana Rockies, and Alaska Range in the coldest part of the winter. Aluminum poles (such as electrical conduit) have their problems as well. Some criteria for choosing diameter, wall thickness, etc for PVC, aluminum, etc would be useful. Also commentary on repairs when poles or attach points break (fiberglass, for example, presents severe problems for field repairs, even with the sleeves and angle splints). People have experimented with bearings or teflon liners at the pole attach points with varied success. Summarizing these discussions would also be useful in a single source like your pdf. You show rear fins/rudders, but do not mention full-length runners. I have found (and discussed here) that a pair of full-length runners made by pop-riveting 1/2 inch aluminum angle (with a tapered front helps tremendously with tracking, especially when traversing moderate slopes, and it helps with that short distance across the parking lot to the trail. Plus it stiffens plastic sleds significantly.

From Rick Kuenstler from NYC

Ed,
Thanks for the email. I ended up going with a Padded web belt and LBE (load bearing equipment) suspenders. They are available at most Army surplus stores and are pretty cheap. The straps hold up the belt and is designed to carry a lot of weight (soldiers use them to carry ammo, water, etc.) We finally have some snow on the ground so I got a chance to try out my hip belt harness and it works really well. The whole belt setup only cost me about $15 at an Army surplus store and is very comfortable.

Photos my customers have asked me to send.
Examples of attaching EWS channels to a EMMCO BEAST

Possible attachments of EWS channels to Jet Jr.

Note form Feb 2008

Other than the above photos- the last updates of this booklet were attached in 2006. I have been getting lots of suggestions from customers and have made several improvements of my own. I find that I am too busy on these projects to continue trying to keep up with desktop publishing software and keepng this booklet current.

In order to provide the quickest turn around on new information and to allow input from customers who have different ideas and concepts than I do- I will be creating a blog on my web site at www.skipulk.com dedicated to keeping you informed on the lastest about pulks. Look for this blog starting in March of 2008.

The Minnesota Ski Pulk

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The Minnesota Ski Pulk business is more of a passion than a business. Owner operator, Ed Bouffard, has been involved in outdoor pursuits for over 20 years with credits that include Outward Bound and instructing at the National Outdoor Leadership School. He has taught telemark skiing in over 12 states and is actively involved in leading a family oriented ski club that includes outings throughout Minnesota.

The Minnesota Ski Pulk designs were tested from the Boundary Waters of Minnesota to the Colorado Rockies and the White Mountains of New Hampshire and Baxter Park in Maine. It is being used by collegiate outdoor programs as well as resort and rental operations. This year they will be used in Patagonia Argentina and and Alaska. During our testing we used it to carry injured skiers, lanterns for candle light ski events, trail grooming equipment, winter camping gear, firewood and even to help pack a ski trail.

Our basic mission is to provide a quality pulk system to as many outdoor enthusiasts as we can, so we provide the experience while you provide the labor and materials. Those who do not have the time or mechanical aptitude can also purchase complete systems or parts of systems directly from Ed at his web site. www.skipulk.com

For more info, please call (320) 253-4573.

Updated 10/06

Build Your Own Ski Pulks

* Complete assembly instructions
* 8 Different Designs
* Parts resources

We have learned from our mistakes over ten years of designing and testing homemade ski pulks.... so you will not have to.

This booklet was last edited in 2006. As additional information and ideas get developed they will be discussed on a blog at www.skipulk.com