

Nordic Ultra-Tune Update

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Fall Edition, September 2003

Volume 6, Number 1

Welcome!

Welcome to the 2003-2004 ski season! This newsletter marks the fall re-opening of Nordic UltraTune; by the time you receive this, we will be up and running – so get those skis in now and avoid the rush!

All skis received prior to October 1 will receive free hotboxing!* Another incentive to do pre-season tuning before the snow flies.

We are offering no new grinds or services this year, but I am in the process of developing and in-line water-cooling system. In the past, I've added ice to the reservoir before final structuring, as really cold water/bases make for a cleaner final finish. The in-line system will allow the work to remain cold throughout the entire process, which will contribute to an even more "open" base and better wax absorption.

Other good news is that prices will remain the same for the immediate future. (Should there be an increase in FedEx shipping charges, I may need to increase shipping cost).

* with thanks to Zach Caldwell, who informs me that "skis" is not spelled "skies" as it was in the first draft, nor "ski's", skii's", or "skie's". For more on Zach, see his well-spelled website at <http://www.engineeredtuning.net/heatbox.html>

And...I'm very pleased to announce that NUTS will now officially be providing grinding services for **Alpina/Madshus Racing** (see www.alpinaracing.com), **APU Nordic Ski Center** (Jim Galanes' program in Fairbanks, (see <http://nordic.alaskapacific.edu/>), Torbjørn Karlsen's training group (see <http://www.fasterskier.com/>), and the **Toko Tech Team** (www.TokoUS.com).

We've worked closely with Madshus, APU and Toko for some time, and welcome Torbjørn's group to the NUTS "family" with pleasure.

To accommodate each of these teams better, we will now be stocking **Solda, Star, Swix**, and **Toko** waxes for base impregnation. Customers with preferences for any one of these brands are invited to let me know, and post-grinding base soaking will be done with the wax brand of your choice, at no extra charge. As the various ingredients of one brand may interfere with the properties of the ingredients of another brand – and as especially initial base wax goes deep and lingers long – it may well be a very good idea to do initial base work with the wax brand you will be using later. (NB: World Cup Plus waxing will be available in Star and Toko waxes only, owing *not* to any statement about quality, but because I simply cannot stock large quantities of high-fluoro waxes).

Rilling

It may seem odd for a stone-grinding service to be writing about rilling, but there are two observations that need to be made, based on both ski in-take, and on questions received. To address the latter first:

Finer grinds, such as LJ03 will often work well up into conditions with more water present that they are designed for. However, if a grind is simply too fine for the conditions you find yourself racing in, rilling may well be in order.

To “wet up” an LJ grind, please use a riller that presses structure into the base, as opposed to cutting it. I favor four rilling devices, each of which has its own advantages:

- 1) The Swix Super Riller (the red plastic one) – this presses in rills, and because of the springs/guides on the sides, is easy to use in a straight line. I like to have a .5, a .75, and a 1 mm “blade” – the 2- and 3mm “blades” are simply too coarse (see below).
- 2) Any rilling bar: there are very simple, and the cheapest rilling tool you can find. Get a long one however – 6” or longer – as the really short ones are hard to hold, press, and steer.
- 3) The Toko “rolling riller” – inexpensive, effective, compact. Will do linear or interrupted structure.
- 4) The Jenex “rolling riller” – the most “benign” and sophisticated riller on the market, with both cross and true linear structure. Does linear and interrupted structure

(Note that there are a few “Rolls Royce” tools out there, usually described as a “black box” – but these are *very* expensive machines, and cut, rather than press in, structure.)

The advantage of pressing structure into the base, over cutting, is that pressed-in

structure will “heal” itself to some degree, as the base is ironed and scraped. You’re stuck with cut-in structure, which means that for in-field, emergency wetting-up of a base, is there for life, making the ski less effective when you return to colder, dryer conditions.

Several rilling structure:

- 1) Simple linear: simply press in a .75 or 1mm structure, tip to tail.
- 2) Simple combination: press in a 1 mm structure, then press in a .75 structure over it: this will give you a “interrupted” pattern as the grooves feed in and out of each other (don’t worry about going too straight)
- 3) Combination structure: interrupted rills (medium – *not* coarse!) down the back 2/3 of the ski; coarser liner (.75 or 1mm) down the back 1/3 of the ski, over the interrupted rills; .5 or .75 linear rills down the front 1/3 of the ski. The idea is that not much structure is needed at the tip, the interrupted rill break suction, and the final linear over-lay “drains” the ski.

But what sparked all this of was that linear rills are not the best thing for wet snow. Especially in the form I sometimes see them when the skis come into the shop with very coarse, linear structure pressed deep into the base. At times, it takes a good deal of grinding to get this out at all, the more so as it is hard to get rills in evenly: one side may be much deeper, or one section of the skis may be far harder to smooth out. As the person who has to rescue the skis, then, a few words of advice if rilling is needed:

- 1) More, finer structure is generally better than less, coarser structure. The old Swix “barbecue” brush could be very good in wet snow because it created “more rills to the inch” than a coarse riller (hence more actual rill, and less “blank area”). This is why various combination structures work better - they “drain” the ski better
- 2) It is not necessary to go too deep.

Nonetheless, no matter what rilling tool or technique you use, you can't do much, if any, permanent damage, so if conditions do swerve of in unexpected directions, plunge in, practice, learn. As Joshua Reynolds remarked, "If you have great talents, industry will improve them; if you have but moderate abilities, industry will supply their deficiency."

And you can always send them in for grinding!

No-wax skis

Although Nordic Ultratune is primarily a racing service, we do get no-wax skis to work on from time to time, and indeed, more and more of the ski producers are coming up with very good no-wax racing skis which, in those horrible conditions around zero Celsius, are starting to win races. Indeed, at the Gunnar Hagen Memorial race last season (Kongsberger Ski Club, see <http://www.kongsbergers.org/>), Madshus no-wax skis won the first two spots in the Masters' category, and a silver in the Juniors.

The following is from a note I sent to customers who had bought Madshus Multigrip skis last season, and here pass it along for general information:

No-wax skis need to be stone ground! Just as with a "normal" ski, the structure put into the base by grinding relieves suction and produces a much faster, "freer" ski. Generally I use the LJ03 grind, but some experimenting at the end of the 2002-2003 season seemed to indicate that the R2.3 grind was even better.

Three things need to be emphasized:

- 1) This is a racing ski, built on a modified klister camber. This means the mid section of the ski is stiff, to keep the no-wax pattern from touching the snow

except during the kick phase. For this reason, a good kick with full weight transfer is needed. These skis are not for all-purpose touring – they are fast, and they will kick well with good technique and in the snow for which they are designed.

- 2) The Hypersonic Multigrip ski was designed to function optimally in 0° snow, right around freezing, where it is difficult to get a grip wax to work. I have tested them in this kind of snow, and found the kick to be quite good. It is less good in wet, coarse snow, or in loose snow.
- 3) *Fit* is very important.

For optimal performance, please treat the kick pattern with a commercial paste wax. I strongly recommend Toko Dibloc high-fluoro paste wax, but most wax companies have a similar product, such as Swix F4. Avoid the most liquid products, as they come off easily. -- And please treat the glide zones as you would the base of any racing ski: frequent waxing will be rewarded by improved performance.

Hotbox Construction

I've had a lot of inquiries about how to build a hotbox. I'll be glad to help out in any way I can, and I have photographs that I can e-mail to customers on request.

My hotbox is the simplest possible construction, and took me only an hour or two to throw together. Following are some general directions, but there are probably as many ways to put one together as there are people who want one...

But first, a note: there have been some cases of skis "blowing up" while being hotboxed. In every case I've heard of so far, this has been due to over-heating, or to improper/uneven heat distribution (e.g.: direct radiation). Skis are made under heat, at up to 115°C, and will not come apart in a

hotbox if the temperature is kept within bounds.

I am currently using my hotbox at between 50 and 60° C – no more.. P-tex begins to melt at 85°C and goes into full melt-down at 135°C. Any temperature below this will not effect the base, and I have had no cases where the core was effected. On the other hand, wax “flows” at temperatures below its actual melt point, and will bond to the amorphous portion of the polyethylene as a product of time/temperature. In other words, the higher the temp, the faster the bond, the lower the temp, the more time will be needed. At the same time, it needs to be noted that an iron, to melt a wax, usually needs to be at melt point *plus* 20°. With higher melt point waxes, this pills iron temperature well into the danger zone for the base material, and almost all irons, no matter how vigilantly watched, will “spike” up into dangerous temperatures.

Finally, both practical tests (skiing) and more laboratory-like tests (weighing) have shown that a great deal of wax is absorbed through hotboxing, and that the wax, presumably because of deeper and better penetration/bonding, lasts longer and is more abrasion-resistant.

The Box

- My box measures 85 x 23 x 20 inches (L, W, D), and is constructed of ¾”plywood. Dimensions, other than length are not crucial, and the box can be as wide or as narrow as needed, given the number of skis you wish to put in it. Mine handles 5 pairs.
- Inside the box, across its width, are two 2” x 4” boards, for the skis to rest on, base up.
- The heater is a oil-filled “baseboard” type, about 7” high, by 36” long. The cord goes out through a hole in the bottom of one side of the box. I chose the oil-filled heater as these seem to hold more even temperature.

- I have two fans inside the box, to circulate the air and keep the heat more even.
- The material and insulation of the box are immaterial, I feel, as temps are not high enough to warrant insulation; heat loss is minimal.

The most important factor is maximum heat, *which should not exceed 60°C!* The sensitivity of the thermostat in the heater is not vital: the temperature can go up and down, so long as it does not exceed the maximum temperature. Most heating units have a built-in thermostat which will not go over about 60°. Use a good thermometer to check the maximum heat, and adjust the thermostat accordingly.

Time is important. The longer the skis are in the box, the better the wax penetration will be. I feel a minimum of 45 minutes is skating close to the bottom end; over-night may be fine. Something in between may be best.

Remember: it is not necessary for the wax to be molten in order for it to bond/penetrate with the base – though admittedly, it is more satisfying.

The Grinding Process

Pre-grinding: All skis are initially scraped with a steel scraper. This allows me to get a feel for the base material, and it quickly removes most of the scratches, old structure, etc. that have accumulated, and flattens the skis somewhat. (Note: owing to our bridge system, it is *not* necessary to remove bindings when sending skis to Nordic Ultratune!)

Grinding:

The stone is *dressed*: a specially designed, high-grade diamond is moved across the face of the rotating stone (the stone generally rotates at 1400 rpm during dressing). This either polishes the face of

the stone, or puts a pattern into it which we produce the base structure desired. *Initially*, a medium “working structure” is put into the stone (like an LJ03 – depth .04 mm), which is used for *flattening* the base of the ski, and for removing any scratches. Depending on the condition of the base (hardness, depth of scratches, degree out of flat) this will take between three and ten passes through the machine.

The stone is dressed again, this time to the finest possible *polish*, at maximum rotational speed and minimum diamond speed. Polishing is done in three stages, with .02 mm setting of the diamond each time. This creates a perfectly smooth stone/base, so that subsequent structure goes into a “clean slate” and is not complicated by residual underlying structure. This polishing normally takes 3 to 4 passes through the machine.

The stone is dressed a third time, this time to put the structure into the face of the stone that will result in the desired base structure (LJ03, R2.3, etc.). When doing different structures on different skis, the stone is *polished* each time a new structure is needed. This is both time-consuming and expensive, because of diamond and stone wear. In the case of say, a R2.3, with its three types of structure, the stone will have been dressed three times, and polished three more times, for a total stone loss of .30 mm of stone. And xc02 will take two dressings and two polishings, etc. This is why the more complex grinds cost more: more stone and diamond wear.

Other steps in the process:

During grinding, the ski is continually washed with water. This serves two functions: it keeps the ski cool so that there is no burning due to excessive heat build-up; and it keeps the ski and stone clear of any build-up of base material. The water is kept as cool as possible, and when the final structure is put into the base, I add ice: the colder the water and base, the cleaner the

structure (and the more “open” the base, that is, minimal peripheral melting). In addition, the water is continually filtered with a three-part filtration system that Lars Svensson, Zack Caldwell and I have developed.

After final grinding, the ski is chemically cleaned. This removes any super-fine build-up or base material or oil (the grinding water contains a small amount of emulsified oil to ensure both lower cutting temperatures, and cleaner cuts).

After cleaning, the ski is visually inspected for any faults, and buffed, using a special soft steel roto-brush which cleans out the bottom of the structure far better than Fibertex or Omniprep. Because of the quality and sharpness of the stone, there is *no hair* on the base of the skis and buffing is *not needed* to remove hair, as it is when skis are ground with dull stones. If there are tiny *stone tears* in the base, these are minimized with Fibertex or Omniprep, and then with the steel brush.

Stone tears are caused when a grain of sand comes off the base. They are rare, but they do occur. Generally, these are so fine as to be hard to see, and they will often become invisible after a few waxings. They have no effect on ski speed, so I generally ignore them. (They are most common in LJ02 grinds, where the structure we are putting in is taking the stone to its limits in terms of fineness.)

Finally, all skis are at least travel-waxed, generally with Star Uniblock yellow (or Toko Worldloppet yellow), an extremely soft paraffin, which insures maximum base penetration. If requested, I will also wax with Toko. If indicated by the customer, I will also hotbox (maximum wax penetration) or follow the whole *World Cup Plus* waxing protocol, which hotboxes four layers of structure/temperature appropriate wax into the base.

Post-grind treatment:

It is best to put as much wax as possible into the base of the ski. I prefer to put in a layer of graphite- or molybdenum-based wax about every four or five waxings as this helps the base to preserve its dry-lubrication characteristics and to retain wax; it will also help with preventing the bases “graying” from use.

It is further a good idea periodically to put a very hard layer of wax into the base (I use Star MAP Black, or Toko LF Gray). This hardens the base, and allows it to retain wax better, as well as resist wear. I do this even with wet/warm-snow skis. And with cold snow skis, I feel it is a good idea periodically to soak them with a soft paraffin, in order to maintain a high level of saturation.

Ironing:

Bases begin to melt at a peripheral level as low as 85°C, and full melt-down occurs at 135°. Many irons have very poor temperature control, so in order to melt a given wax, it may be necessary to adjust them so that at the bottom end of their on/off cycle, the minimum temperature is still warm enough to melt the wax into the base (remember that an iron will normally have to be 10-20° warmer than the melt point of the wax, in order to compensate for heat loss into the base). This means that at the *top* of the on/off cycle, the iron may be *above the melt point of the base*. Three things are *strongly* recommended:

- 1) Use a good iron, designed for waxing (no holes!), with the best temperature control you can afford. Star, Swix, and Toko all sell good irons, and the more expensive ones have better heat control. Avoid light travel irons, Goodwill bargains and your old clothes iron like the plague. *A good iron is the best insurance you can buy for your skis!*
- 2) Rub on a layer of wax (if the wax is too hard to rub on, heat it by touching it to the iron, then rub on). This ensures that there is even wax distribution, and also

that there is a thin layer of wax insulating the base from the iron. After rubbing a layer on, drip more wax onto the base. You don't need to use the dip method, but within reason, the more wax the better, to ensure getting enough into the base, and to avoid “dry” spots where the iron directly touches the base.

- 3) Iron in stages: After rubbing/dripping the wax on, iron the ski in one continuous pass down the length of the ski (or glide zone, on classic skis). *Keep the iron moving*, to avoid undue heat build-up. Make four or five passes down the ski, then set the ski aside, base up, and do the next ski. Go back and forth between the skis, ironing four or five times each pass: the idea is to keep the wax warm (not necessarily molten) as long as possible, but *not* to allow too much heat build up.

Wax and bases

Wax does not just go into the “pores” of the base. It is absorbed into the structure of the sintered polyethylene that makes up the base. This absorption is a product of *time* and *temperature*: the higher the temperature, the faster the absorption. Clearly however, there are diminishing returns, which begin to have an effect at 80°C, the melting point of the base material. For this reason, low-temperature ironing, within the context of the melt-point of the wax, is better for the base.

Wax does not need to be molten to be absorbed into the base. In the case of very hard, high melt-point waxes, absorption still goes on as low as 50 or 60° C. This is one reason why I have moved almost entirely to the use of a hotbox for waxing bases (I use an iron only to spread the wax).

The hotbox:

The hotbox is very simple. It is a wooden box large enough to hold five pairs of skis flat and base up. There is a heater in the box which is strong enough to maintain a

constant maximum heat of 50-60° C. There are two fans inside the box to circulate air and help maintain even temperature throughout the box.

Before hotboxing, wax is spread over the base using a Swix digital iron. The skis are placed in the box for a minimum of 40 minutes (the number of pairs I have to do dictates that a longer time, no matter how desirable, is practically impossible.) Experiments have show three things:

- 1) Skis actually increase in weight, showing that wax absorption is occurring (we have not tested longer VS. shorter periods of boxing).
- 2) At these temperatures, skis can remain in the hotbox as long as overnight. (Factory temperatures exceed 110° C for brief periods: 50-60° will effect neither the base nor the glues.)
- 3) Wax adhesion/wear is greatly enhanced.

Further Considerations :

Fluoro Application: Apply fluoros over a good base of fluoroparaffin: fluoros only adhere to fluoros, so a heated-in layer of fluoroparaffin gives the pure fluoros an anchor in the base (I generally sub-layer a graphite of molybdenum wax below the fluoroparaffin for greater adhesion and better base wear). I apply pure fluoros – solid or powder – as follows:

- 1) Sprinkle or rub a liberal layer of fluoro onto the base, as evenly as possible (solids are easier to apply evenly, and less is wasted falling onto the table or floor).
- 2) **Very quickly**, “tap” a iron down the length of the base, to “fix” the fluoro. The iron needs to be around 135°, so this must be done fast and gently.
- 3) Cork the fluoro in with a fluoro-dedicated, plastic cork. This takes some pressure and cork speed, but suddenly the fluoro will go “soapy”. Continue to cork until the fluoro vanishes and is

evenly distributed – 20 or 30 passes of the cork.

- 4) You can also use a roto-cork, but if you do so, you should
 - a) Use a dedicated cork that has been broken in and “filled” with fluoro
 - b) Avoid too much speed, and keep the roto-cork moving, to avoid burning the base
- 5) Spray the base with water. This helps the fluoro molecules to align evenly, and reduces dangerous aerosols – “dust” – in the air.
- 6) Brush with a fine, fluoro-dedicated brush. I prefer a roto horsehair brush, but other brushes will do as well. Be sure however, that the bristles are fine enough to get to the bottom of the structure.

Summer and long-term storage, travel

Always store skis with a good layer of paraffin on the base. This prevents base damage owing to dirt, “oxidization,” and exposure to ultra-violet light, all of which will eventually seal a base and prevent wax absorption. I prefer to store skis with hydroparaffins, and fluoroparaffins go all white over a long period. Whether this is damaging or not, I do not know – but it looks awful.

Always wax a skis before travel, to protect the base (and travel with the ski bases, separated with proper ski ties. Keep them in a bag. Be a fanatic, and keep the bag inside the care or in a rocket box.)

“Oxidization” of Bases

Last spring a number of customers wrote to me with regard to base oxidization. I jumped into a minefield on this one, and there was a pretty large amount of back-and-forth on the internet. In the end, I think I may stick to the *term* but it’s becoming clear that what really happens to bases is something else, and both a bit more

complicated and a bit simpler, than “oxidization” – so here’s the “state of the art” as far as Nordic Ultratune at the moment – input, refutations, death threats are all welcome (seemingly, *nothing* gets people so riled up as politics, religion.... and ski bases!)

First, since the subject of the oxidation of bases keeps coming up, I think it's worth mentioning that a Pennsylvania State University study on ski wax and base prep from a number of years ago (Street and Tsui, 1/29/87) pretty much dismisses the whole idea. To quote them: "It is occasionally stated in the popular literature that ski wax helps protect the ski base material from oxidation. This is clearly a myth. The ski base material on racing skis is made of ultra high molecular weight, sintered polyethylene; this includes the ‘black electra’ base which is sintered polyethylene with a carbon filler. These base materials are chemically inert, which means that they tend not to oxidize or react with other molecules or chemicals. Polyethylene, in fact, is used in containers that hold all types of chemicals including concentrated acids, which are usually strong oxidizing agents. There is no reason to think that ski wax serves to chemically protect the base material of aging skis."

I put part of this question of Roberto, the head chemist at Star several years ago. He said that the gray spots one often see on bases after skiing were fibrils of P-tex which had come loose (like micro-hair) and lost the stove black and graphite that makes ski bases black. These fibrils wipe or brush off easily, because they are so fine.

Two things will help prevent this problem:

- a) Ironing in a hard wax - this will harden the base and keep it from “shredding”, and
- b) Ironing in a graphite- or molybdenum-based wax, which will keep the base *looking* black (as well as providing both anti-static and self-lubricating benefits,

which are the real purpose of these waxes). To this end, and to keep things simple, I use hard, graphite- or moly-based waxes as a sub-layer, and apply them every three to four waxings, which Roberto recommended as often enough.

(Note that using a harder wax as a matrix for the graphite, etc. will, in effect, harden the based, which will also improve wear-resistance in many cases.)

Of course, having a flat ski with no highpoints, and a ski with proper flex and weight distribution, will also help, by eliminating high-wear spots. Equally, careful ironing will prevent burning the base, which produces areas which will not absorb wax.

First, an anecdotal bit of information relative to this much-vexed question:

I have seen skis that have been left unwaxed for prolonged periods. They have been very hard, sometimes almost impossible to steel scrape or to grind; and they have often had a sort of gray “powder” on them which is clearly base material. Scraping & grinding has gone down into a clean, “open” layer, which accepts wax. Clearly something is going on, regardless of the Penn State study and its scoffing at “myths”. Although this probably is not oxidization, *something* is occurring.

But to find out more, I went on the internet. Google came up with 15 or twenty pages dealing with oxidation of polyethylene, among which were a paper (Number 394) by Yannick Luisetto, Prof. Frans Maurer and Prof. Bengt Wesslén, sponsored by the Department of Orthopedics, Lund University Hospital; Scandimed (For further information please contact Yannick Luisetto, yannick.luisetto@polymer.lth.se). Now, I know less than nothing about chemistry, but I quote from the opening of their paper: “The aim of the project is to increase the resistance to oxidation of Ultra High Molecular Weight polyethylene

(UHMWPE). Two different approaches will be used to do so. First an annealing treatment will be performed to reduce the amount of free radicals present in the material, and secondly an anti oxidant will be added, which would act as a radical scavenger.” This was in the context of the polyethylene used in hip replacements, and the project description further reads:

Oxidation (and the decrease in wear property that it is associated with) is the main cause of total hip implant failure. Two causes of oxidation have been identified: the free radicals that remain in the material after gamma-irradiation, and the attack of the body environment.

The gamma radiation can break the polymer bonds creating free radicals, which can further on recombine to give a cross-linked material with increased wear property. The problem is that part of the free radicals do not react and stay in the material. When oxygen is present, an oxidation reaction starts and the wear property decreases.

So polyethylene *does* oxidize, although most of us in the ski industry are not in the habit of gamma radiating our bases, and we can dismiss “the attack of the body environment.” But I have a question: does direct sunlight or air involve gamma radiation to any degree that effects skis?

From the preamble to another paper, presented by Barbara H. Currier, John H. Currier, Lauren C. Sutula, Hanover, John P. Collier, DE, Hanover, and Michael B. Mayor, MD, Hanover, NH, we read: “Polyethylene oxidation resulting from gamma sterilization *in air* [my italics] can cause embrittlement and reduction of mechanical properties in shelf-aged and retrieved components.”

I also found:

Effects of Sterilization Methods On Ultra-High Molecular-Weight Polyethylene

(UHMWPE)
(<http://www.orthoteers.co.uk/Nrujp~ij33lm/Orththruhmwpe1.htm>):

The common understanding of the oxidation mechanism is as follows. UHMWPE initially consists of extremely long molecular chains which makes it an excellent abrasion-resistant material. Sterilization by gamma radiation causes chain scission by breaking chemical bonds and creates reactive free radicals. Oxygen diffuses into the material and reacts with free radicals to cause oxidation, which leads to much shorter molecular chains. As a result, the original properties of polyethylene, including abrasion resistance, change significantly.

However, in a way, this is a bit like the various theories about why/how wax works (dry lubrication, wet lubrication, controlled friction, snow crystal deflection). They are all useful, they all explain more or less of what's going on - but no one really knows (a recent Austrian study threw the water droplet theory out). What we *do* know is that bases go white and “dry out.” And they do get hard if you leave them unprotected.

I continue to think that using the phrase “dry out,” while it has offended purists, describes accurately the way bases *feel* when they, well, *dry out*. So I’m going to be unrepentant in my continued use of the phrase. I’ll have to reconsider oxidation, but until someone comes up with an accurate term, “oxidation” is certainly easier shorthand than “the hardening effect frequently observed in unprotected Polyethylene ski bases” or some such gobbledygook.

It's all a bit like Ptolemaic astronomy, which was supplanted when a better theory explained what better observation came up with. The old earth-at-the-center theory was wrong, but it worked: it explained observed phenomena.

Finally, I received the following from Lars Svensson, who knows about as much about ski bases as any man alive (Lars did the stone grinding for the Norwegian Team for many years, until the Swedish Team bought out his contract. In the last Olympics he prepared bases for both Sweden and Germany, flying over Tazzari machinery – now owned by Zach Caldwell at Engineered Tuning – from Sweden. Lars works closely with Star; I have edited as little as possible):

Nat,

Nice to hear from you, hope everything is ok in Edmonds. As far as I have been able to follow there has not been that much of snow in your area during the winter, as I know that you have customers from all over the country I am convinced that you have had enough to do anyhow.....

Here in Sweden we have had a tremendous good winter (" as I remember they used to be when I was a little boy ") with early snow and also for a long time snow almost all over the country. Increase of STAR orders with more than 35 %. Good results for the Swedish (and AMERICAN) teams among others with new STAR gliders in V. d. F. for sure I know Per was using STAR glider in the duathlon race.....

Furthermore Golden medals in Swedish Championships, World Cups, Vasaloppet.....

About oxidation of P-tex bases it like this, when people define this as if something happens with the base itself, like written about it in your attached letter. It is totally wrong. The matter is that as he also writes in his letter that nothing happens with the base itself but when skis are stored for a long time, with or without wax on it, due to affect of air pollution, ozone ray and other things will have a layer of " oxide ", (pollution) on top of either the base or the wax.

On bases without protection wax, this layer of " oxide " will, if you do not clean the base properly before starting saturating the base, be transported into the amorphous ["pores" – the part of the base that absorbs the wax - NRB] zones of the base and 1) reduce the possibility for the wax to penetrate into the base and 2) be a part of the wax and also then reduce the glide of the ski when the wax starts to work as a lubricant.

On a base protected by wax for example during the summer, the normal and right way to start working before using the ski is to scrape and brush the protection wax out of the base before starting the work for skiing.

If you have a base with protection wax stored for longer time and then start with melting the paraffin directly, without scraping and brushing, you will almost have the same problem as if you start to saturate an un-protected base without cleaning it after long time storage. The " oxide " will be transported into the amorphous zones of the base together with the paraffin.

This makes clear there is a misunderstanding among a lot of skiers about oxidation of ski bases, when people in the " expert skiworld " talk about oxidation we always mean what I have described above and when the letter to you says, "There is no reason to think that ski wax....." it shows this misunderstanding very clearly: no professional ever says that the ski wax protects the base from " oxidation ", it is a coverage that absorbs the pollution (" oxide ") making it possible to scrape and brush it away before you start further work on the base. As I said before, oxidation is never meant as something that happens directly to the base itself.

Nat, I know that you also know everything about saturating of bases, and because of this is so natural and basic to you, I think you did not enter into this question about oxidation from the right angle and therefore

you thought it was something quite different..... Am I wrong ?? I don't think so...!!

Mark Twain

It may not be quite as shameless as paying myself a compliment, but I do want to include the following letter from a customer, with thanks:

Enjoy this copy of the Nordic UltraTune newsletter? Please forward it to a friend; subscriptions, via e-mail are complimentary – and it helps to spread the word! Or send us names/addresses and we will pass on a copy.

Nat,

Thanksgiving Camps

I lost my subscription when I changed email addresses. Would you please put me back on your subscriber list? There are a lot of newsletters out there. I find yours easily the most informative and scientific. Keep up the excellent work by stone & pen!

For customers looking for good Thanksgiving camps and/or just a good place to take advantage of early-season snow and ski over the holiday, let me draw your attention to Silver Star, near Vernon, in British Columbia, Canada (see <http://www.silverstarmtn.com/>)

Not that you need another testimonial...I'll give you one anyway. I had a pair of Madshus that were new two years ago. Between lousy conditions here and inappropriate race-day conditions, I hadn't used them more than 10 km in all that time. You ground them for me last spring. I literally took them out of the bag and undid your tape the day before the Birkebeiner, waxed them up, & placed my faith in them. To put this in perspective, I weigh 130 pounds fully dressed and toting a full water bottle and GU packets. I am not used to careening past larger skiers and doing it out of track in "the rough." I had that joy this year. Thank you for those priceless moments of exhilaration!

Although the US dollar isn't as strong against the Canadian dollar as it was last year, there are many good places to stay at Silver star, ranging from condos to hotels. My favorite, and one of my "short list" hotels is the Silver Lode:

The Silver Lode Inn, Swiss Hotel
146 Silver Lode Lane, P.O. Box 3005
Silver Star Mountain Resort
Vernon, B.C. V1B 3M1
Tel: (250) 549-5105
Fax: (250) 549-2163
Email: swisshl@junction.net
Web page: www.silverlode.com

The Shipping News - Lines from the old curmudgeon...

If you can find a better restaurant anywhere, I want to hear about it! A large selection of dishes is complimented by an excellent British Columbian wine list. The cooking and the service are superb, the hotel is 50 yards (or less) from the start of the trails, and the rooms are spacious and comfortable.

Please read, mark, and inwardly digest! The NUTS Work Order Form includes the plea/order: *No Styrofoam "peanuts"!*

Letters

There is a very good reason for this, illustrated today as I unpacked the last grind of the season. A very good customer, who has been a customer for a long time, and who I *know* lives a blameless life and who without question intends no evil, has sent me *three* boxes, *all* stuffed with Styrofoam peanuts.

"If you can't get a compliment any other way, pay yourself one."

What I assume happened is that said customer went to his local mail shop and handed the skis over to the sales person. This individual, apparently considering that skis are as fragile as Ming vases, or else abhorring a vacuum and feeling in the depths of his sensitive soul that a very large box indeed needed filling, placed two pairs of skis in each of three very large boxes, and filled them up with the aforementioned “peanuts”.

It is almost impossible to open such a box without spilling a few handfuls of peanuts, and *completely* impossible to remove the skis without pulling them out, and spilling all the peanuts.

The last time this happened, it took me 45 minutes and three shopvac emptyings to get all the peanuts out of the shop - time I might add, that I had rather have spent getting some skis done! Since this episode, I have started opening such boxes outside, over the garbage bins. Alas, with three boxes, a wind, and the size/length of the boxes, it is impossible to catch all the peanuts, nor did I have room in the bins for three box loads of the bloody things!

Result: peanuts all over the driveway. My non-recycle bin completely full (and one ski box still half full), and half an hour spent chasing the things in the wind, which while good for my physical training and agility....

Well, you get the picture.

So PLEASE!!!! Do not ship skis in peanuts! Do not let mail-shop personnel do so.

Anyway, If your skis were so fragile that they needed all that protection, you wouldn't want to ski on them! As a rule, wrapping something around the tips and tails may help protect the skis, and it is probably a good idea to wrap the bindings in an old towel or something like that; especially Rottefella bindings, with the over-hanging footplate, are a bit vulnerable to the more enthusiastic

handlers at the USPS, FedEx and UPS – although out of several thousand pairs shipped in, there has been *no* damage.

Please! No more peanuts!!!!!!

PS: Just a little later, the same day: *Another* box has just arrived full of peanuts! Now both my garbage bins are full, and I have no place to unload these skis – or to store all the packing.

<p><i>Remember: all skis received prior to October 1 will receive free hotboxing - Another incentive to do pre-season tuning before the snow flies!</i></p>

Enjoy this newsletter? Then please, give us a hand – and forward it to any of your ski friends who might be interested. Subscription is free: just send an e-mail to nathanielbrown6@verizon.net

For full prices & services, as well as a Work Order Form, please see our website at <http://www.ultratune.net/>