MASA Planet

Volume 6, Issue 2 **Remember Columbia** **March 2003**

Safety First!

High Anxiety

Ten steps to avoid that sinking feeling.

Ted Cochran, NAR 69921

As your rocket arcs over and heads earthwards, you watch it trailing smoke, and wait for ejection. And wait. And wait. At last! A puff of smoke! But the nose cone stays on, and the rocket screams into the ground. Or the nose cone comes off, but the parachute doesn't come out, and again, a nice rocket becomes a not-so-nice rocket.

Ted Cochran

Ah, chute.

I hate it when that happens. It's happened to some of my nicest rockets, too: A Saturn V, a 2X Mars Lander, a Broadsword, and a Silver Comet, among others, have all fallen victim at one time or another to shy chute syndrome. They're all flying again, but they aren't quite as pretty as they used to be.

Once in awhile, the ejection charge is weak, and there's not much you can do about it. Estes D12 motors had this problem for awhile. But often, the problem is something you can avoid, and save yourself some serious time in the workshop, to say

High Anxiety, continued on page 2

Also in This Issue

High Tech

Turn Your Own Nose Cones on a Lathe

Part 2: For every cone, there is a reason: Turn, turn, turn (Apologies to Pete Seeger)

Jon and Katie Hayman

Last December, we discussed a variety of ways to design and lay out a nose cone. Now we are ready to get to work.

First, we need a brief description of the lathe. The left-hand side of a lathe consists of a headstock fixed to a heavy lathe bed, and driven by a belt and motor. The tailstock is located to the right and can be slid sideways on the lathe bed and locked down to accommodate various lengths of wood blanks. The work is held between two centers: a drive center in

Katie Hayman

Headstock (top), and tailstock with tool rest

Nose Cones, continued on page 2

High Anxiety, continued from page 1

nothing of a potentially scary event on the field. So, let's go over some things to check.

First, make sure the parachute is in, and attached to, the rocket. You might be surprised how often people forget that simple, but important, step!

Second, confirm that the motor has good retention. If the motor blows out the back, the nose cone may not come off the front.

Third, check the nose cone tightness. If the nose cone is very tight, the ejection charge will pressurize the body tube, but the body tube will hold the pressure until it can escape out the rocket motor's nozzle. That's a really tough way to get extra thrust!

Make sure the parachute is installed!

Fourth, check that the nose cone isn't too *loose*. What's that, you say? Well, loose nose cones, particularly large ones, can cock sideways and get stuck (like my Saturn V, unhappily).

Fifth, make sure the chute is properly packed, wrapped, and protected. Use cornstarch or talcum powder on plastic chutes.

Sixth, if the chute is a tight fit in the body tube, take extra time to pack it particularly carefully, lest it get stuck. In my experience, you can't wrap suspension lines too tightly, but wrapping them loosely often leads to trouble in the form of tangled lines.

Seventh, make sure your pistons slide, your baffles are clean, and your wadding isn't overabundant!

If you're using reloadable motors:

Eighth, make absolutely sure that the ejection charge is in place. People do forget to put it in, and the result is never pretty.

Ninth, make sure the ejection charge stays in place. For small motors, make sure that red cap is tight! For larger motors, back up that sticky paper disk with masking tape all the way around the edges.

Finally, make sure the igniter is in place, firmly against the delay charge. Otherwise, the delay won't ignite properly, and ejection will come too late.

Being conscientious about these things will definitely help you keep the pointy end clean!

Nose Cones, continued from page 1

the headstock spindle, and the tailstock center. The drive center has a central point on its face that is surrounded by two or four spurs or tines. These tines have a chisel-edge and firmly hold the work so that it can be driven by the motor.

Rather than get into a detailed discussion about turning wood on a lathe, we advise you to read your lathe's operation manual or one of the many books that cover the subject. If you have never used a lathe before, we strongly suggest that you ask an experienced operator or school shop teacher to help you, or take a short course in its use. For example, Woodcraft in Bloomington, MN periodically offers one-evening courses in the operation of a lathe. For nose cone turning and for safety in general, it is critical that you know how to sharpen the lathe turning tools. This subject is usually covered in lathe books, or you can ask when you take a course or purchase the tools. Free-hand sharpening takes a lot of practice, but you can make up for that lack of expertise by using reasonably-priced sharpening jigs. Dull tools are dangerous, and can quickly ruin your nosecone as you turn it down to the small diameters needed at the tip. Also, wear safety glasses or a face-shield, and tie back long hair and secure loose shirtsleeves.

Tools

To turn nosecones, you will need:

- A roughing-out gouge
- A smaller gouge (handy, but not necessary)
- A skew-chisel
- A parting-tool (sometimes also called a cutoff tool)
- Sharpening equipment/jigs
- A pair of machinist calipers and dividers
- A steel ruler
- Dial calipers (for accuracy in turning the technical nose cones we discussed last time)
- Short and long tool rests for the lathe
- Various sizes of sanding blocks and 80-grit adhesive sandpaper (e.g., Porter Cable)
- Finer-grit sandpaper as desired for final finishing
- A fine-toothed pattern maker's rasp or wood file is also helpful, but not necessary.

Some of these tools are shown on page 5.

Nose Cones, continued on page 5

MEETING SCHEDULE

TUESDAY, MARCH 11
(ONE WEEK LATER THAN USUAL)
Location: Science Museum of Minnesota, St. Paul
Time: 7 PM to 8:45 PM
Topic: Large Model Rockets and Level I certification

FRIDAY, MARCH 21 TO SUNDAY, MARCH 23
NARCON 2003
San Diego, CA
See: http://www.narcon2003.org/

TUESDAY, APRIL 1
Location: Science Museum of Minnesota, St. Paul
Time: 7 PM to 8:45 PM
Topic: Design Review Meeting for Rocket League
See: http://www.hightechkids.org/IRL/index.htm

THURSDAY, MAY 1 (NOTE CHANGE)
Location: Science Museum of Minnesota, St. Paul
Time: 7 PM to 8:45 PM
Topic: LCO/RSO Training session

LAUNCH SCHEDULE

NOTE: TIMES AND LOCATIONS SUBJECT TO CHANGE!
CHECK THE WEB SITE FOR UPDATES

SATURDAY, FEBRUARY 22
MICHAEL ANDERSON MEMORIAL LAUNCH
Location: Apple Valley High School
Time: 10 AM -2 PM
Team America Challenge Launch

SATURDAY, MARCH 1 & MARCH 8
Location: Apple Valley High School
Time: 10 AM -2 PM
Team America Challenge Launches

SATURDAY, MARCH 22
DAVID BROWN MEMORIAL LAUNCH
Location: White Bear Lake
Time: 9 AM -Noon

SATURDAY, APRIL 26
KALPANA CHAWLA MEMORIAL LAUNCH

Location: Elk River
Time: 9 AM -Noon

SATURDAY, MAY 10
TEAM AMERICA ROCKETRY CHALLENGE
The Plains, VA

SATURDAY, MAY 24
LAUREL CLARK MEMORIAL LAUNCH
Location: Blaine
Time: 9 AM -Noon

MAY 24 THROUGH 26
National Sport Launch
Clarks Summit, PA
See http://www.nepra.com/nsl/

President's Corner

Greetings!

Glen Overby

I think most of you know me from meetings and launches, but I thought I'd start my first letter off with a brief introduction. Like many of you, I first flew rockets in grade school, but by the time I got to high school I had stopped completely. A few years ago I retrieved my model rocket collection from my parents' house, and started looking for a field from which to fly them. I found MASA through a link on the NAR web page and visited a launch in Blaine.

I returned the next month with a few of my old rockets. However, it was a Tripoli Minnesota launch later that summer where I really got bit by the rocket bug! Now, I regularly fly with both MASA and the two nearby Tripoli prefectures. Professionally, I'm a software developer at Silicon Graphics in Eagan.

This year has gotten off to a busy start, with more outreach activity and exhibits than launches! I appreciate those who have stepped forward to help out with these events!

Our February launch will be held at Apple Valley High School where we will join students from AVHS and (hopefully!) other nearby high schools who will be working to perfect their Team America flights.

There have been some changes at the Minnesota Science Museum where we hold our meetings. The museum will be closed on many of the Tuesdays on which we would normally hold our meetings. After taking an informal poll of the officers, I decided to move the meetings to Thursdays instead of searching for a new location. The meetings that had to be moved, and their new dates, are listed below:

Thursday May 1
Thursday June 12
Thursday September 4
Thursday October 2.

For those who want to see it again, Space Station 3D is showing at the Minnesota Zoo Imax theater.

I am always looking for suggestions and feedback from club members.

Glen Overby, MASA President

Junkyard Rockets

Reduce, reuse, recycle.

Stuart Lenz, Elliott Lenz, & Ted Cochran

Last year's last Blaine launch of the season saw four rather, um, interesting-looking rockets take to the skies--the products of MASA's first Junkyard Rockets competition, patterned after the popular TLC show.

Stuart Lenz

Stuart and Elliott Lenz organized the competition. The rules required teams to build rockets entirely of parts selected from the Lenz' extremely well-stocked bucket of rocket junk, safely eject a standard BT-50-sized payload for the longest possible duration, and meet an impossibly short five minute return deadline, all on 15 Nsec or less of total impulse. Rockets were built during the October meeting, then impounded until they could be flown at the October launch. Three teams elected to fly two stage rockets using B6-0 motors in the booster and B6 or C6 motors in the sustainer. The Pink Team (David Whitaker with guests Adam Major and Christy Evenstar) built *Super Junk*, a two stage BT50 rocket, by hacking up a gold-colored wreck.

Ted Cochran

The Red Team (Alan Estenson, Ted Cochran, and Seth Cochran) created *Red Dawn* by mating the body section of a Custom *Elite* to a BT-50 payload section with a triangular nose cone made from cardboard and abundant quantities of masking tape. Their booster section was scratch built, and employed a "unique" socketing system to mate the sustainer to the booster.

The Blue Team (Jeff Hove, with MASA guests Matt Spenser and Jonathan Svendsen), built *Altair*, a sleek and well-engineered two stage rocket using a BT20 sustainer with a BT50 payload section and what may have started life as a Quest *Navaho* booster.

Ted Cochran

The Orange Team (Mike Erpelding, Lee Grunn and MASA guest Jeff Lynum), built a traditional single stage 4FNC rocket that appeared to be half Estes *MK109* and half *Astrosat LSX*.

On launch day, *Red Dawn,* launched on B6-0 to C6-7 motors, ejected near apogee and achieved a respectable payload duration of 50 seconds, despite some excitement during staging. The Red Team were allowed by the rules to make quick repairs to their blown coupler, but since their first flight was qualified, they decided to rest on their laurels and defer further flights unless their initial duration was beaten by the competition's later efforts.

The Blue Team's *Altair*, also on B6 to C6 power, ejected its payload much higher: It stayed up for well over a minute. Unfortunately, although the payload stayed on the field, the rocket drifted into the Great Eastern Rocket Eating Forest. Fortunately, it was eventually found, but unfortunately, it was not returned by the deadline. Succeeding attempts recorded qualified flights of 39 and 42 seconds duration.

The Orange Team's entry recorded 26 seconds after a disqualification on the first flight, and the Pink Team's *Super Junk*, flying a C6-0 to A8-5, weathercocked, and, handicapped by a heavy airframe, only managed 17 seconds.

First prize, an Estes Orbital Transport kit, went to the Red Team. Since Ted had already built and flown one, and Alan has one in his "to build" pile, the kit went to Seth, who intends to keep it from becoming fodder for future competitions. With many more parts left in the junk bin *[gee, we wonder whyÖ :-) -Ed.],* Ellison and Stuart are looking forward to this year's event.

Nose Cones, continued from page 2

Katie Hayman

Basic lathe tools (L to R on bench): dividers, calipers, turning tools, dial calipers, steel ruler, long tool rest, Inset: L to R: skew chisel, parting tool, rough gouge, fine gouge.

Woods to use for turning

We have made nose cones for high-power rockets out of black walnut, maple, and basswood. The choice of using hardwoods or softwoods is yours. We have found the hardwoods easier to work with when it comes to contouring the smaller diameters near the tip. Hardwoods flex less as the work thins out, and you can often turn the work down to 1/8" without the nosecone breaking off of the lathe.

Getting set up

At this point you have a nose cone drawn out full-scale on a sheet of paper, or for the technical-type nose cone, you have a list of stations along the length of the nose cone with the diameter for each station. For technical nosecones, stations 1/2" apart are recommended, otherwise 1" stations work fine. The distance between the stations will depend on the size of your nose cones. We mostly turn large cones for high-power rockets, so 1/2" or 1" stations work fine. For smaller nose cones the stations will be closer together. The goal is to have enough stations so that you can see the profile enough to cut the curve between each station accurately. Note that you may need to adjust the exact location of these stations, or include additional stations to mark transition points where one contour is changing to another. For this article, we will describe how to turn out the odd-looking Soviet M100b nose cone (shown on page 34 in Peter Always' book, *Rockets of the World*), and then follow up with extra details on turning a Von Karman shape in the next issue. Based on the techniques used to turn these sample shapes, you should be able to turn out virtually any other nose cone shape, as well as boat tails and transition sections.

The first task is to glue up wood stock to make a blank that is thick enough to cover your base diameter or body-tube diameter. Use epoxy glue or titebond (water-resistant) wood glue. Leave yourself at least 1/2" extra thickness over the base diameter. For the total length of the stock, include 3" or 4" extra length taking into account the total length of the profile plus the shoulder below the base. After the glue dries, cut a little off of each end of the stock so that it is reasonably square, and draw an "X" corner to corner on each end to locate the center. Use a punch or drill out the center point on the stock a little to accommodate the drive center point of the headstock and tailstock. If you are using a hardwood like maple, one end should be chiseled out from the center along the "X" lines that you drew earlier so that the tines on the headstock drive center will bite into the stock. That will prevent your work from slipping as you work it on the lathe.

Roughing out the blank

Mount the stock on the lathe according to your lathe's instructions, and mount a long tool rest as close to the

continued next page

stock as possible so that the stock's corners clear the tool rest as it spins. The tool rest is usually secured a little below the center of your work. The first task is to use your large gouge to rough out the stock so that it becomes rounded. Set your calipers to a size a little larger (1/2" or so) than the base diameter of the nosecone and turn the entire length of stock down to that size. It is okay to hold the calipers up against your work in motion to check the size ***after*** the stock becomes round. See photo below.

Katie Hayman

Stock mounted on lathe, in the process of being rounded by the large gouge

Cutting the first stations

We have found that the most efficient way to turn nosecones (assuming that you are right-handed) is to cut the shoulder and curved profile from left to right with the shoulder on the left (headstock side) and tip to the right (tailstock side). The thickest parts of the nose cone are always shaped / sanded first before moving on to the thinner areas. The tip should end 1" or less from the tailstock center for reasons we will explain later. Measure back from the tip to where the shoulder starts (where the shoulder meets the base of the nosecone) and move a sharp pencil (or sharp end of your dividers) up to that spot to mark it as the work is turning. This is your starting point for finer cuts, and we will call this STA (station) #1. Refer to Figure 6 below (Note: This figure is not to scale).

For now, also mark stations 2 through 5 on your stock. It is important to first cut the shoulder and stations 1 to 5 first since these are the thickest areas of the nosecone. Why?? If you start initially roughing out the thin areas, you introduce a weaker point in your stock. Because of the loss of the supporting stock, this thin area will start to flex away from you as you move your cutting tool up against it. Because of this flexing, the tool will also start to "chatter" as it attempts to cut.

Chatter should be avoided as long as possible, because tools have to be sharpened much more frequently, and there is also the possibility of uneven cutting. When you go back to work on the thicker areas, you will now have a harder time doing the final profiling / finishing because those thick areas will now flex and have a tendency to chatter just like the thin area. Also, when you cut a thin area in your work, the rest of the stock will start to wobble slightly. That is due to the pressure you initially used to secure the stock on the lathe by tightening the tailstock against the center point of your stock. That pressure will cause your work to warp somewhat as it gets thinner, and makes it more difficult to finish the thicker areas. There are several ways to deal with this problem later, but for now we avoid this situation completely by only working on the thick areas.

The parting tool is used to set the depth at each station. It cuts vertically into your work so that it leaves a slot. First, adjust your calipers' width to the station

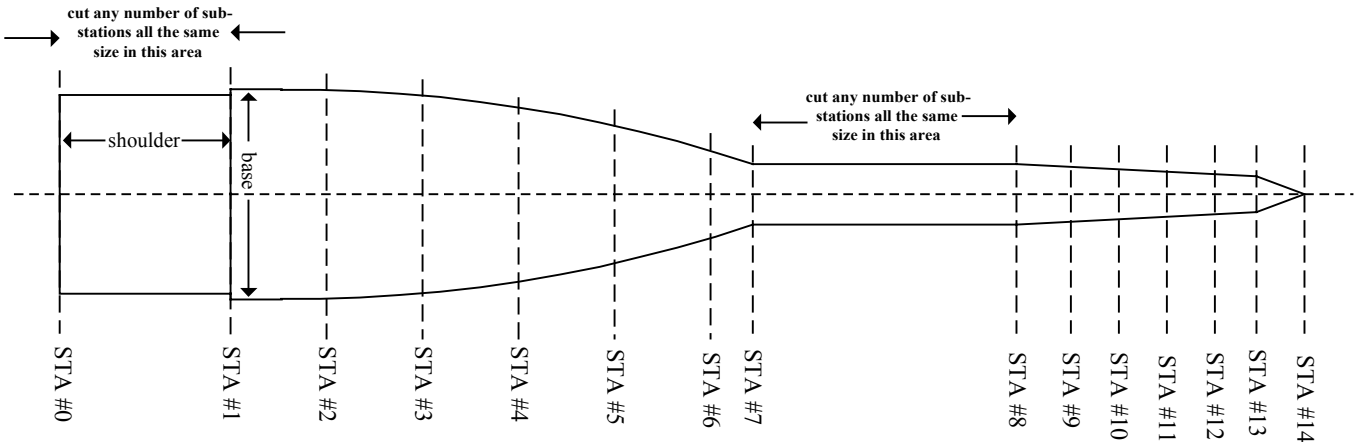

Figure 6

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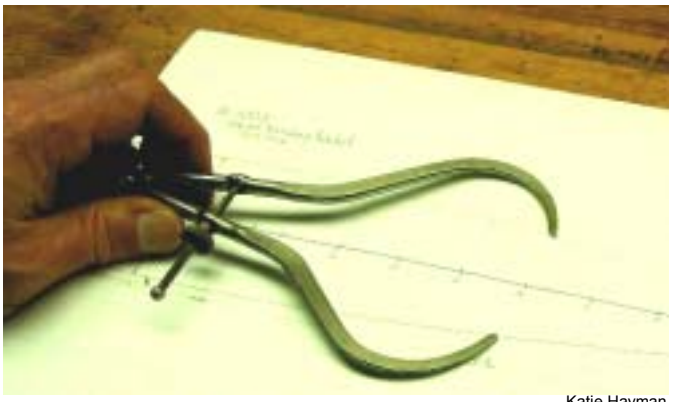
(STA) #1 diameter on your full-scale drawing, as shown in the photo below. Use the parting tool to cut your rounded stock down to the depth represented on your calipers. To do this, you place the LEFT edge of the parting tool blade so that it lines up with the mark you made on the stock for STA #1 (see Figure 8). In other words, whenever you cut a station to the proper



Katie Hayman

Setting your calipers to the station diameter

depth, you always form the cut on the RIGHT side of your mark (assuming that the nose cone's diameter decreases as you move to the right as is the case with the nose cone above). If you centered your parting tool on the mark, or cut to the left of the mark, you would end up cutting too deep to the area immediately to the left of the station. As you cut the station, check the depth frequently with the calipers with the stock in motion. The calipers will slide easily into the slot left by the parting tool allowing you to constantly check the depth. One technique used by experienced turners is to cut the station with the right hand, and use the other hand to hold the calipers up against the slot surface being formed on the backside of the stock. Approach the final depth slowly so that you don't accidentally cut too deep.

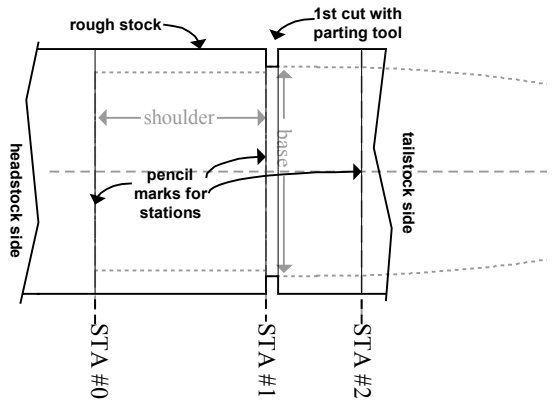


Figure 8

Cutting the Shoulder

Before we move on to the other stations to the right, let's get the shoulder of the nose cone done first (the area between STA #0 and STA #1). Set your calipers slightly more than the shoulder diameter, and place your parting tool so that the right edge lines up with STA #1 (which is now the left edge of your last cut). Cut down to the depth matching the caliper opening. Make sure your parting tool is sharp before doing this step -- you are forming the base/shoulder line of the nose cone with this step. Also make a cut on the right edge of STA #0-- this is the border of the nosecone shoulder. Now, make any number of additional cuts between STA #0 and STA #1 to the same depth (see Figure 9 below).

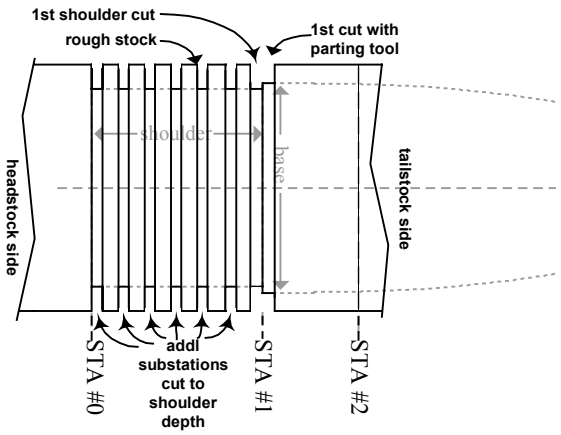


Figure 9

The bottom of the initial shoulder cut and each substation cut forms the reference line for the shoulder. All you need to do is remove the remaining rough stock in-between the cuts. Use the small gouge or skew chisel to take these down to small nubs. Also, use the parting tool to cut a section of stock down a ways immediately to the left of the STA #0 line. This represents the end of the shoulder, and is sawed off at the end of the project after you take the work off the lathe (see Figure 10).

The last step in this phase is to sand the remaining nubs down to the shoulder line, and then sand the whole shoulder down slightly further so that it matches (or is slightly less than) the inside diameter of your body tube or airframe. Carefully check the final shoulder diameter with a dial or digital calipers if you have them. It is much easier to take the stock down

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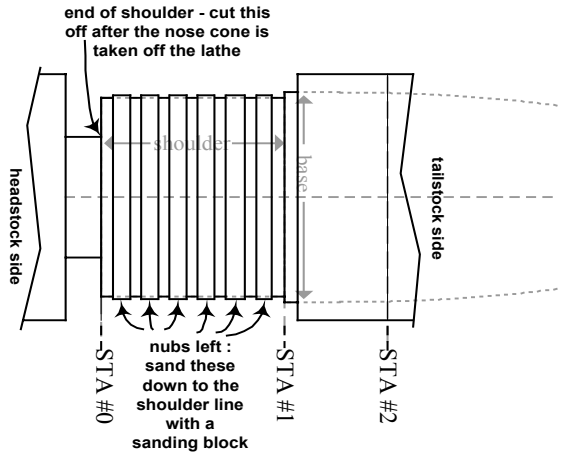

Figure 10

evenly with sandpaper while the work is turning on the lathe.

Your sanding block should have a square edge, and the 80-grit self-adhesive sandpaper should be trimmed off evenly with the edge of the block so that you can sand right up to where the shoulder meets the base of the nose cone. Since the upright edge of the block has no sandpaper on it, you can butt the sanding block right up to the base edge of the nose cone without damaging the line between the shoulder and base (see photo below). Approach this edge carefully so that you leave a clean line. As you sand with your block, keep the block moving up/down and back and forth. This prevents friction burning of the sand grit, and helps to keep your shoulder line straight. You can also use a sharp skew chisel on the tool rest to take this small section of shoulder down. The whole point of this detail is to leave a clean, seamless base line so that the nose cone looks good on the rocket. We have found that you can usually do a better job with this detail than nose cone suppliers can!

Final sanding of the nosecone shoulder Katie Hayman

Cutting the Nose Cone

We are now ready to move to the right of STA #1 to start forming the main curved contour of this nose cone. The Soviet M100b nose cone drawn above is not to scale, but the real nose cone has a short, straight section from STA #1 to STA #2. STA #2 is the transition point between the straight section and the start of the curved section. Remember earlier that we said that you might need to adjust the exact location of your stations, or add additional stations? STA #2 is an example of this. You will place the left edge of the parting tool on the STA #2 mark and cut down to the same depth as you did for STA #1. Treat the straight section between STA #1 and STA #2 the same way as you did for the shoulder -- cut as many substations as needed to form a straight reference line.

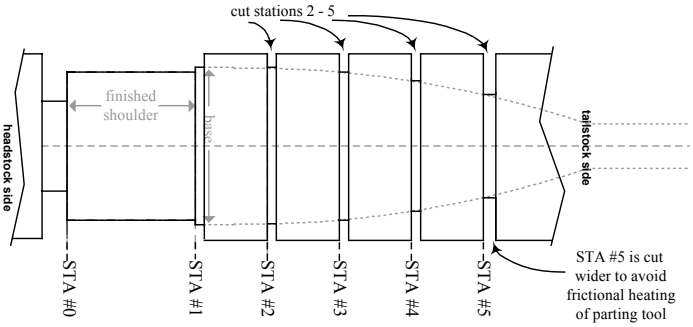

Figure 12

Go ahead and cut all of the other stations down to STA #5 the same way, setting your calipers to the diameter of each new station (see Figure 12). As you start

Katie Hayman

Cutting with the skew chisel -- watch that top profile as you cut!

continued next page

cutting deeper into the stock with the parting tool, the friction will build up on the sides of the tool due to rubbing action on the stock. This heating will cause you to lose the sharp tool edge faster than normal. To avoid this, make another half-cut to the right with the parting tool to give yourself extra space from the slot-walls. Make these extra cuts frequently as you cut down to the final depth set on the calipers.

As before, all you need to do is remove the remaining rough stock in-between the cuts. You can remove some stock a little further to the right of STA #5 to give yourself some room to work in that area. Start out with the large gouge, and move to the smaller one as you approach the contour line. When you get close, switch

Katie Hayman

Fine profiling with a sanding block

to using the skew chisel for finer stock removal (see photo, previous page). When viewing the changes in the contour line as you cut the stock with the tools, it is best to watch the top of the work as it rotates on the lathe. Be careful not to cut too deep in between stations.

When you get sufficiently close to the profile line (small nubs left), switch to your sanding block and profile sand to a smooth curve moving the block back and forth (see photo above).
The flat side of a wood file can also be used for this operation. After that is done, you can fine-sand with strips of sandpaper backed with masking tape to make the sandpaper last longer, or just fold up a sheet in half. As the work rotates, hold the paper

Katie Hayman

Final sanding

around the backside of the work (keep your hand away from the tool-rest!) Keep the sandpaper constantly moving up/down and sideways along the work (see photo above).

At this point, you have the shoulder and profile done to STA #5. Rough cut the remaining stock to the right (all the way to the tailstock center) to approximately the diameter of STA #5. With your pencil or dividers, mark all of the other stations to the right of STA #5, and use the parting tool to further mark each station to a depth of about 1/16". As above, the left edge of the parting tool will line up with the station mark as you cut. Note that when placing station marks a given distance apart, we include extra stations wherever needed, especially at transition areas (i.e., STA #7, #8, #13, and #14). Cut to the proper depth for STA #6 (the last station on this large curved section), and then set your calipers to the diameter of the straight spindle. Cut STA #7 and #8, and any number of sub-stations in between the two (see Figure 16). This is a good time to switch to a short-length tool-rest if you were using a long one. As you work on these stations you will eventually notice a high-pitch chattering noise as you cut with the tools. It's time to sharpen your tools and

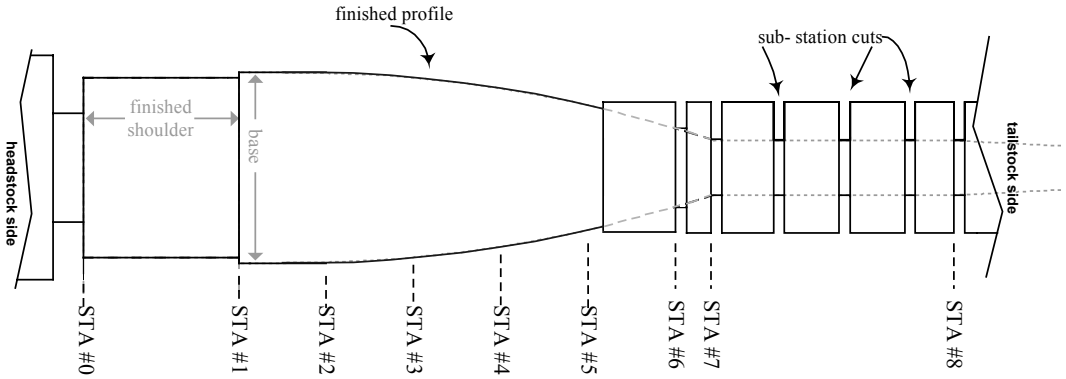

Figure 16

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make sure your tool-rest is as close as possible to the work.

Chattering can be minimized as follows:

1. Keep your cutting tools razor-sharp and sharpen frequently when cutting narrow spindles

2. Move your tool-rest as close as possible to your work, and use a short tool rest

Professional lathe-turners have a device called a "steady rest" that they use when turning long spindles. A steady rest can be purchased for hobbyist-type lathes, but they are quite expensive. We can get around the need for purchasing this device by building a simplified steady rest or providing some kind of support to the work while cutting these spindle-like sections of the nose cone. In the photo to the left, an assistant is holding a wood paint stirrer against the work as the other person cuts to dampen the chatter / vibration. Another possibility is for the helper to hold the nose cone in the same spot by hand, wearing a leather glove. The helper can work this way for short periods of time, and release their grip periodically as the glove heats up due to friction. For safety, make sure the helper holds the work on the left side (out of line of) the tool rest (This technique is shown on page 13).

Some lathe books describe how to make a shop-built steady rest. You can make a simple one in a short time by just placing a notch on the edge of a 3/4" pine board and lining it with glued-on carpet or leather. The notch is cut big enough to contain the section of work you are cutting, and the board would stand upright on the lathe bench. The helper would hold the notch of the steady rest against the back of the work (to one side) while you are cutting on the other (see Figure 18). All lathes, tools, and conditions are different, so experiment, and use one of the above methods to steady

Katie Hayman

Removing remaining stock between STA #7 and #8

your work from this point on.

Remove the remaining stock in between STA #5 and #7. As you finish profiling this area, you can use the skew chisel to carefully cut up to the transition point starting at the STA #7 mark to leave a neat line (see Figure 19). STA #7 is the starting point for a straight section, which runs through STA #8. Profiling this area is the same as what was done for the shoulder. Remove the rough stock between these stations using the skew chisel to cut the stock down to the reference line set by STA #7 through STA #8 and all sub stations in between. When you get close, use the sanding block again to even out this section and keep it on a straight line (see photo on next page). When you do this, be careful not to move the sanding block to the right of STA #7 (avoid disturbing the line you created with the skew chisel on the STA #7 mark). Fine-sand this finished section.

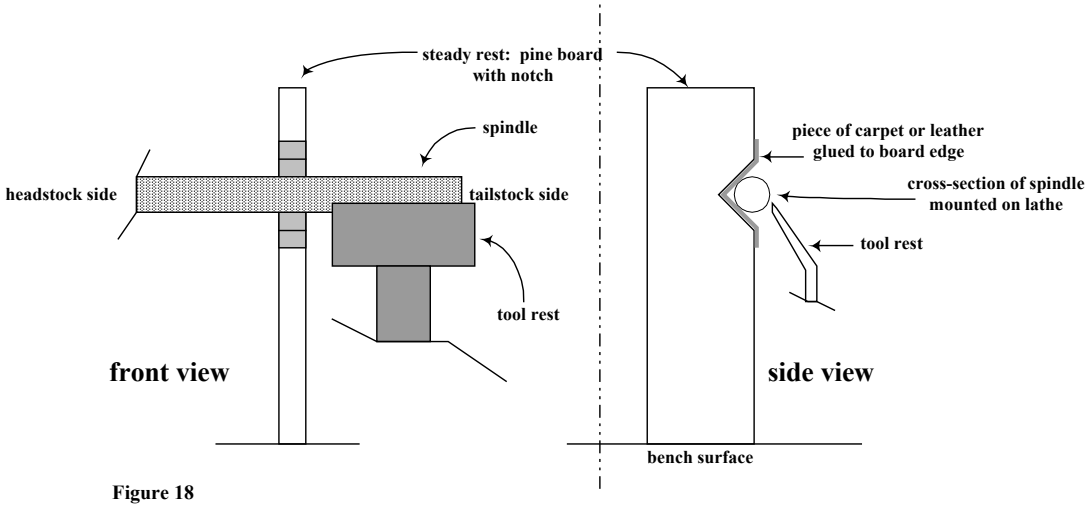

Figure 18

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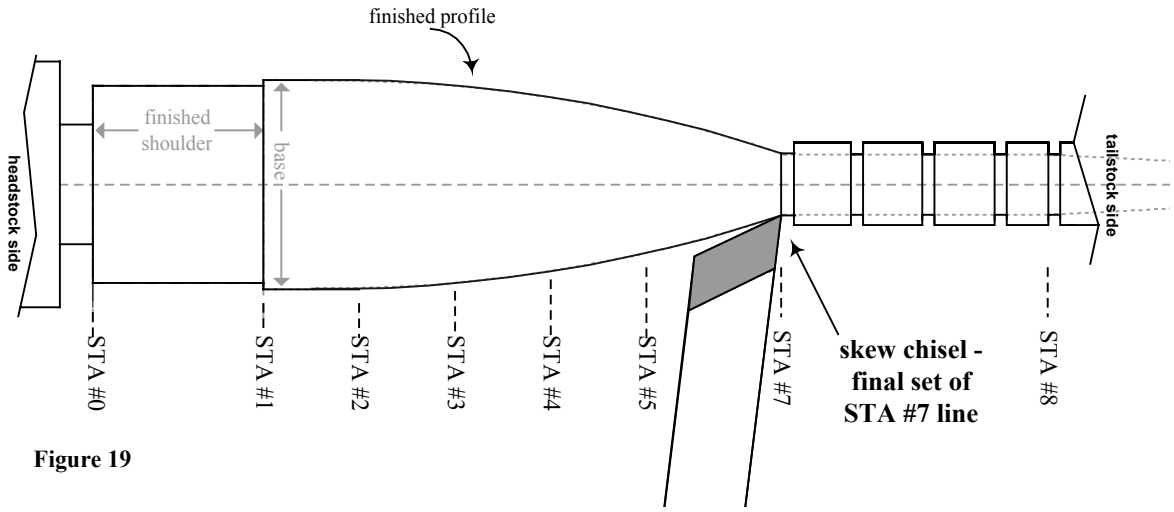

Figure 19

STA #8 through STA #13 is a slight taper (decreasing diameter). Set your calipers to each station and cut to the proper depth with the parting tool. While you are at it, cut STA #14 (representing the very end of the nose cone) down to the depth of approximately STA #11 in preparation for the final step later on. Remove all rough stock in between, use the skew chisel for final profiling, and again use your sanding block to insure that the taper stays in a straight line (Figure 21; photos on next page). Remove the rough stock between STA #13 and STA#14 to the depth of STA #11.

Finishing up

We now have the nose cone completed through STA #13. The final step is touchy, so pay attention! There are at least three ways to finish the point on a nose cone:

First, professional lathe turners usually have a device called a "lathe chuck" that they can attach to the headstock. It has a similar function to the chuck on a drill press, but it can be much larger and is oriented horizontally. What they might choose to do is just cut the nose cone off at STA #14, and chuck the nose cone's shoulder in this device. They would then turn the lathe back on, and use a sanding block to form the point. This lathe chuck, like the professional steady rest, is expensive, so you probably don't have one.

Second, on the headstock end to the left of the nose cone shoulder, you could turn about two inches of stock down to a narrow straight spindle (dowel), and then cut the nose cone off the lathe. Then, you'd chuck

Katie Hayman

Final profiling STA #7 to STA #8

the end of this dowel (still attached to the nose cone) in a drill press or large hand drill, and proceed as above, and form the point with a sanding block. The success of this operation depends on the size nose cone you are turning and whether you have a drill press or hand drill with a large chuck. If you are turning the size nose cones we are, and don't have access to a drill press that can accept a LARGE diameter bit, it probably isn't worth

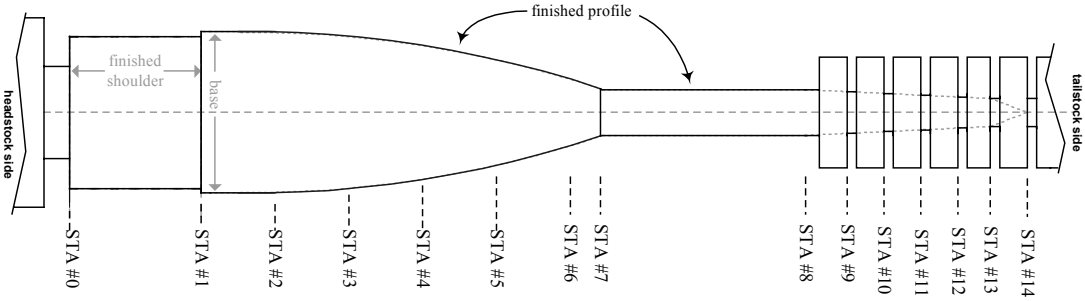

Figure 21

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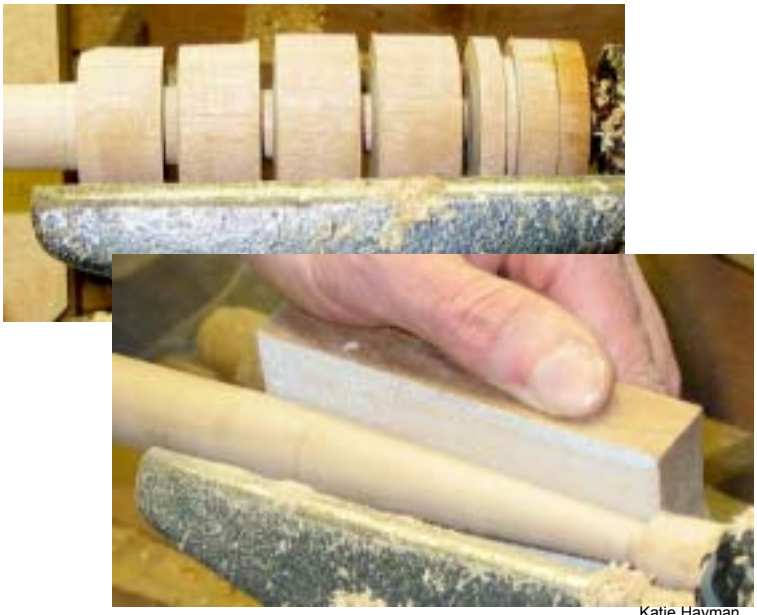

Katie Hayman

Finishing the taper toward the tip.

trying this. We tried this method once, and wish we hadn't - it was much more trouble than it was worth. You would have to create this spindle off of the shoulder earlier on, and you guessed it -- you would introduce another weak point in your work that would cause difficulty in turning down other areas of the stock. Remember that we wanted to avoid creating narrow areas until the last phases of the nose cone formation? You may have to turn this shoulder dowel down much further than you would like in order to fit it into your drill/drill press, and it would be risky doing this when you are at the other end trying to create the more important narrow areas towards the tip. The entire work would also wobble much more, and your shoulder dowel may end up not being straight with respect to the tip. The whole structure will probably wobble in the drill press. If the nose cone tip wobbles while you try to sand it, the sanding will probably be uneven.

The last method is to cut as much of this final point as you can while the work is still on the lathe, and then take the work off of the lathe and form the remainder of the point yourself with a sanding block. We have used this method with all of our nose cones so far except one, and you wouldn't be able to tell they were done by hand.

In the beginning of the article, we mentioned that the end of the nose cone should be an inch or less from the lathe tailstock center. In case you were wondering why, this is one of the most stable points left on your work (other than the headstock end) because it flexes the least compared with other stations to the left. At this spot, we have the best chance to turn at least part of the final short cone (where the nose cone ends) before it breaks off the lathe. If we are left with a partial contour to follow after the nose cone leaves the lathe, then we can easily form the remainder to the nose cone point by hand with a sanding block. To do this, you will need your helper to steady the work with a gloved-hand and be prepared to "catch" the nose cone when it breaks from the lathe. You can also do this yourself by holding the skew chisel against the tool rest with your thumb (right hand), and steadying the work with your left hand at the same time. Breaking the nose cone off of the lathe is not a big deal -- the nose cone breaks from the weakest point and simply stops turning in your or your helper's hand. The lathe headstock can no longer turn the work because the tailstock no longer supplies pressure to keep the headstock center tines embedded in the work. The trick to this operation is to make sure that STA #14 (the station representing the end of the nose cone) is the weakest point on the spindle so that the worst thing that happens is that the nose cone breaks off at this spot. With hardwoods like maple or walnut, I can usually turn the stock down to 3/16" or a little less before breaking. With your helper in position steadying the work, use a sharpened skew chisel to bite at the proper angle (same angle as the contour) into the rough area between STA #13 and #14. Don't bite deeper

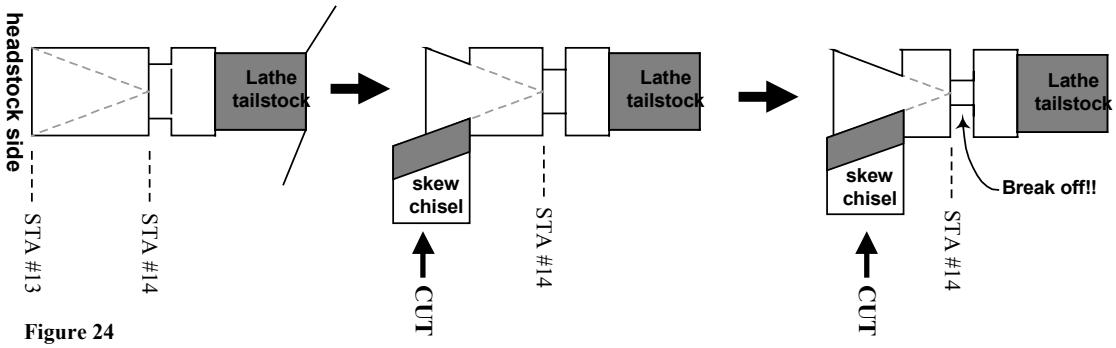

Figure 24

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Turning the tip. Katie Hayman

Final sanding of the tip. Katie Hayman

than STA #14 and make this the weaker area. First, take STA #14 down a bit further, and then work the area to the right of STA #13 down a little further (not exceeding STA #14). Eventually, the work breaks off, but you now have a contour to follow for final shaping by hand (see Figure 24 and photos on this page).

Shape the final cone tip with a sanding block following the contour left by the skew chisel. Stroke upwards with the sanding block at the same angle as the cone, but partially rotate the nose cone with your left hand at the same time as you stroke upwards. Sand only in one direction as you rotate the nosecone by hand for the most even results.

That's it for the Soviet M100b nose cone! In the final part of this series, we will cover some of the issues specific to turning more technical nose cones.

The *MASA Planet* is the official newsletter of the Minnesota Amateur Spacemodeler Association, Section 576 of the National Association of Rocketry. It is published bimonthly as a service to its members. MASA authors and photographers retain rights to their submissions, which are used by permission. The *Planet* is available in color on MASA's web site:

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The completed scale M100b nose cone, ready for a 2.6" body tube.

Katie Hayman

In Memory of the Crew of Columbia

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