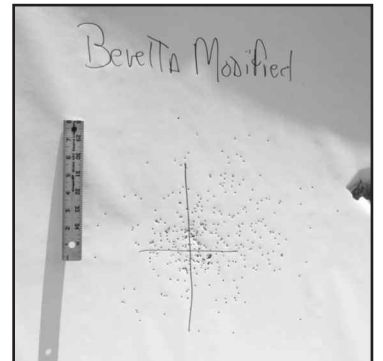
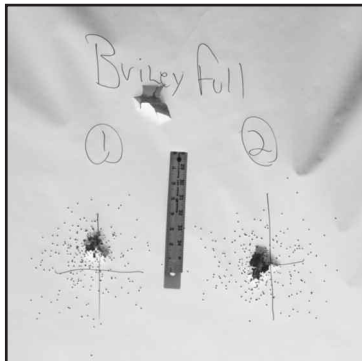
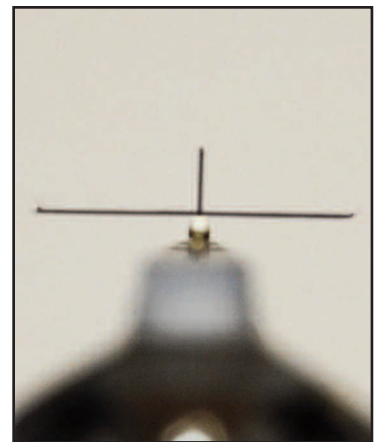
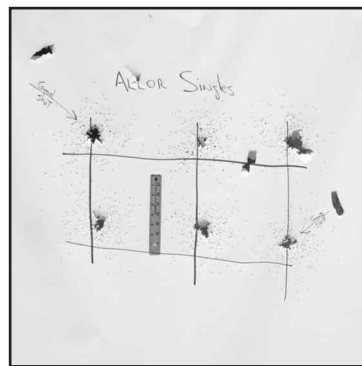
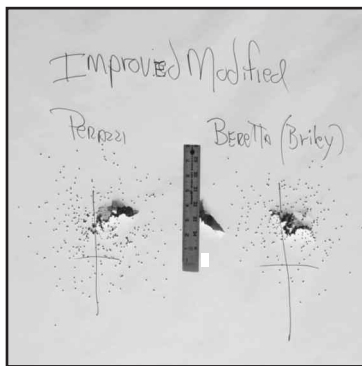
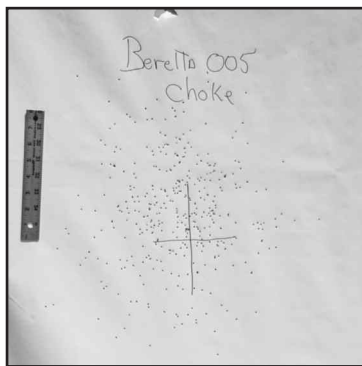


# Point-of-Impact & Pattern Testing at 13 yards



by Neil Winston ©  
Revised February 2011



## Introduction

### My first Perazzi

In the summer of 1982 I fell in love with trapshooting and went to Joe's Sporting Goods in Saint Paul and bought an Ithaca Model 500, an over & under made by SKB, which the salesman assured me was a trapgun since it had a middle bead. I shot the SKB all right, but it, as do so many good guns, merely whetted my appetite for "something fancier, something better" which in those days in Minnesota meant "a Perazzi." So the Ithaca moved out and a well-used Mirage moved in and I was set with my permanent trapgun, or so I thought.

And the Perazzi *was* better. Being a lot heavier, it kicked less and the triggers were snappy and consistent. The stock didn't fit me as well as the Model 500 had, but there were many spare ones floating around, several with the popular and attractive "racing stripe" – that is, a strip of wood grafted-in about 3/4 of the way up the stock to raise the comb – and soon I had something I could get along with.

### Concern begins to grow.

And shooting it was more fun, but it often seemed that if I drifted too far to the right of the bird the breaks were a good deal more solid than when I shot where I had intended to. And a mirrored drift to the left was often a clean miss. "Is this gun shooting straight?" I wondered, "And how can I find out?" My home club, Metro Gun Club in Blaine, Minnesota, had a pattern board and I figured I'd get a little guidance from the roundtable on how it was done, trot down to the board, and have it worked out in a jiffy.

### My first attempts at point-of-impact testing

Following the advice I got from assorted experts over the next few days got me nowhere. Shooting offhand, sometimes I was shooting from 40 yards, sometimes from thirty-something. One shot per target was recommended. Or five shots "to average-out errors." Aiming a stationary gun. Or swinging the gun to the target-shaped aim-point. A lot of time, cardboard, and shells later I had to face it. None of the advice had worked. My shots were all over the place when I could tell where the center of the pattern was (and a lot of the time I couldn't even do that). I still didn't have any idea where the Perazzi shot, but in my mind, it was getting worse and worse.

### What I learned I needed to do.

A few things were clear. I had to get a lot closer. I would need to use a gun rest of some sort so I could shoot with the precision required to learn anything. It was going to take a lot of shots and I was going to need a notebook to keep it all straight. I had to standardize on a distance which I could repeat every time without measuring, so I lined up with the backs of the traphouses at Metro. It happened to be 13 yards from there to the pattern board, so that was the "range" I would use for all my testing. As I spent more time working out a program, I found that I had chosen a particularly lucky standard, since it not only made the math easy, but also allowed good estimates of choke as well. From this emerged "Point of Impact Testing at Thirteen Yards," a widely-used system which has all but taken over as the plan to follow.

### You can test your gun too.

The only drawback to the system is that you actually have to follow it. If you cut corners you will waste time, money, and probably never find out where your gun shoots. If you really want to know, you are eventually going to have to do it right anyway, so why not start that way? The following is my advice on what "doing it right" means. Good luck!

# SECTION 1

- Choice of targets
- Rest and distance
- What to do & what it means

## Choose the size of your target frame

**You only need 24-inch-wide paper if all you want to test is POI.**

Though many clubs have steel pattern plates, few have a way for a shooter to test a gun “on paper” and so enjoy the many advantages of that more complicated but superior technology. Why don’t you build a rolled-paper-target setup for your club and leave it there? The shooters will appreciate it and it’s easier than hauling box and paper from home and back again every time you want to use it. If you plan to do just point-of-impact (POI) testing, you can design a box and frame for 24-inch rolls of 60-lb Kraft paper. You’ll have an inexpensive and practical test facility in a compact size which

works better than a larger one most of the time. The box should be 12x12 inches of 1/2-inch exterior plywood and be about an inch longer inside than the roll of paper it houses. Leave the front longer so you can bolt some six-foot uprights on it and secure a crossbar to hang the paper from. Make sure there is a hinged top to keep out the weather. Add a couple of clamps to secure the paper and you are in business.



You should brace the box as in the picture since unsupported plywood warps. You need something to hold the paper off the bottom of the box and keep it dry; the bracing does that too. The roll of paper lies on the cross-braces and unrolls at the front so it has straight-up path to the crossbar.

Drill a couple of holes through the bottom of the box and drive long spikes through them into the ground so it won’t blow over.



A single bolt screwed into a t-nut securing the uprights to the crossbar allows you to fold them together if you ever want to pack it up and move it. For the same reason, the uprights should be paired with bolts and wing nuts at the bottom. The paper is drawn up from the roll and draped over this crossbar. A pair of spring clamps from the hardware store will hold it there.

### If you want to test both POI and patterns you need 48-inch paper.

To do “real” pattern testing, that is, counting pellet-holes (and there’s little point in patterning if you don’t) you are going to need forty-eight inch wide paper. The setup pictured below is what I consider the ultimate in practicality. It’s simply a longer box than the one I described earlier, housing a 48-inch roll of paper, which will do pattern-testing as well as your POI investigations.



If you count holes by hand you can use Kraft paper but if you want to use the pattern analysis software from Dr. Andrew Jones, Shotgun-Insight<sup>®</sup>, you will need white paper. A 150-foot roll of white banner paper, item number 11501-1224 from Dick Blick.com will last a long time and can be used for both POI testing and patterning. The frame will last a year or two before being shot to pieces by others at the club, but it can be patched up and remain usable for years.

Weight the core of the paper roll with a shot-filled 3/4-inch by 48 inch length of rigid copper tubing to give the roll a little resistance to turning so a breeze won’t unroll the whole 200 yards when a gust hits. But you won’t be doing much testing in a wind anyway since even at 13 yards a moderate side-wind will move the POI quite a bit and make your results of no use. Calm days work best; in fact, only relatively calm days work at all. Save the windy ones for trap practice; no one else shoots then so you will have the advantage of experience at a shoot when it’s blowing and no one else knows what to do.

### Other ways of holding paper or using cardboard, et cetera

Of course sheets of paper will work too. Don’t get the ones with targets printed all over them; they don’t help and are expensive besides. You can make or buy frames to hold loose paper but wind can be a real problem.

Cardboard works and is often free, but you will lose a lot of the information about your effective choke that thinner paper can tell you.

Plan to take a lot of shots and if you find anything that worries you, be sure to come back other days and re-check your results. Likewise if you change the comb, rib, choke tube, or anything else. Think of the board as a patient coach, always available to keep you thinking straight.

## The shooting rest and distance

### Any solid and easily-used rest will do fine

Professionally-produced “bench rests” are available from a number of sources such as Midway and Cabela’s, or you can just make one.

I find the one pictured on the right about perfect. Place the rest so the gun’s muzzle is a measured (not “paced-off”) 13 yards from the paper and mark the ground with spray paint so you can put it back to the same place next time or tell someone else where to place it.

Add earmuffs, some boxes of premium factory light 7 1/2’s, a notebook & pen, and a gun or two and you are set to learn where your gun shoots more efficiently, accurately, and with greater certainty than any other way, especially since there isn’t any other way.



## Pattern Plates

This is a typical “pattern plate.” It’s a solidly-mounted steel plate which, spread with a marking preparation, can show the location of shot-impacts to good accuracy. It’s quick and cheap and works, though, as with cardboard, you lose a lot of information.

Here are excerpts from an April, 1980, American Rifleman article by the NRA Technical Staff, pages 26 to 29.

*“A practical alternative is to use a steel patterning plate. The plate is coated with a non-drying paint which requires only rebrushing to make the surface ready for the next shot. A permanent aiming-point can be applied to the plates’s center.” “No attempt is made to count pellet hits or evaluate the results quantitatively for comparison with other guns or loads.”*

*“This method of evaluating shotgun performance can be very valuable for those who are interested in learning their gun’s potential with a minimum expenditure of time and ammunition. First, it shows the pattern’s center of impact relative to the point of hold. The pattern’s location is often of greater practical importance than its size or distribution.” “A half-hour’s time on the patterning plate will pay well in the information it yields.” “This method of pattern evaluation is recommended for shotgunners not disposed or equipped to conduct tests which yield quantitative results.”*



These aren’t results, they are counterfeits which make you think you have tested something when you really haven’t. They may tell you that some shot strikes what you are pointing at, but not where the bulk of the shot is going when the beads are lined up horizontally and appropriately arranged vertically. In other words, they do not tell you where the gun shoots independently of the person shooting it. That’s what testing off a rest at 13 yards is for.

## How to do the test

**There are just four steps to follow.**

**Step 1.** Set up your target paper and with a wide felt marker put some aiming-crosses on it in the manner of a tick-tack-toe grid.

**Step 2.** Standing as you would on the firing line, mount your gun as you do in preparation for calling for a target. Look carefully at what you see and try to commit it to memory. Is your eye centered on the rib? Exactly centered? How much rib do you see? It may help to use the front bead as a comparison, for example you might estimate “I see about three front-bead-diameters of rib.” If there is a mid-bead, where is it in relation to the base of the front one? Write all this down in your notebook before you take the first shot.

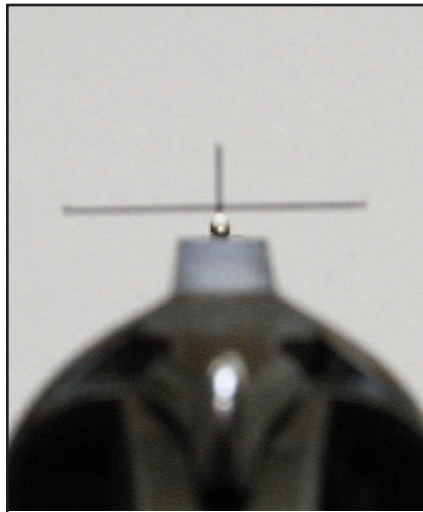
You may be surprised at what you see. Perhaps you are off to the side, the barrel looks bent, or the beads appear off-center. Don’t dwell on that right now; just note and remember it, that’s all.

**Step 3.** Sit and support the gun on the rest or preferably on your supported arm trying to duplicate the visual picture you just committed to memory. You may have to stand once or twice again and get a fresh look, but eventually you will come up with something which is very close to what you see when you are shooting targets.

## Systems that don’t work

Ineffective “testing” systems include shooting at target boxes, shooting offhand, shooting at unknown distances at stray things scattered about, and shooting over water. In terms of finding out where the gun shoots they are useless, though they superficially appear to have the virtue of economy and instant results. But that’s an illusion.

**Step 4.** Load the gun and shoot, aiming at the intersections where the lines cross. Put the top of the bead just at one of the horizontal lines and center the bead on one of the vertical lines as in the picture at the right.



Try to analyze whether, at the moment of sear-release, the gun was pointing where you had intended. Maybe you made a good shot, maybe you think you jerked the gun, maybe you couldn't tell. In any case, write your impression in the notebook with the shot number and where the shot went relative to the cross you were aiming at. With a tight choke you can tell the impact-location close enough from the bench, but it's better to go up to the paper to measure and make sure at least every few shots. A typical pair of entries might read:

"Shot 3, maybe pulled left a little, was one inch to the left and two-plus inches high. Full choke pattern.

Shot 4, a good one, was straight right-to-left and three inches high, a more open pattern than the last one."

I think that accuracy to the half-inch is about the practical limit. Avoiding finer gradations may keep you from obsessing about things which are, for the most part, imaginary.

Keep shooting until you have at least several shots you have called good ones and you see that a clear pattern has developed, a pattern you are willing to call "Where this gun shoots."

## How to decide where it shoots

**Don't "average." Just pick the most typical results.**

Now that you have shot a dozen or more shots and the first thing that stands out is that they are not all in the same place. Some you can simply dismiss, the ones you called "bad shot," and "flinch" and so on, but even the others move around some. Why?

Well, it's not because shotguns are no good at shooting off a rest or the system doesn't work or any of the other things you may have heard. It's just that a shotgun, as does any firearm, shoots a "group" rather than to a single spot. The impact points themselves constitute a pattern. At this range that group is often an inch or more in diameter but it's of little consequence; it's just a warning that it makes no sense to get too precise in your calculations.

You now have a couple of pages of ratings and impact-points. How do you apply a single number or two to your result? I think the best way is to take the "mode" – that is, the most common value – from the shots you thought were good ones. If there are four or five shots to which you have given positive "quality" ratings and which are in about the same place, that's as good an estimate of the POI of this gun under these conditions you are going to get.

Ideally, you will be content with what you have found (surprised though you may be) and can just file the information away as something nice to know or to use to compare with other guns. Assuming you are shooting the gun well, it will help set a new one up or diagnose a problem you may come to have with this gun's replacement or with one of its stablemates. If you are not shooting the gun well, knowing now where it shoots may point you in the right direction toward improvement, particularly if you can compare its performance with one you have more success with.

If you are unhappy with what you have found, don't do anything drastic until you have replicated the test at least a couple of times on different days with a lot more shots. In fact, I think that's a good idea even if all seems well. You want the best estimate you can get, after all, and a second look just to make sure never hurts

## And where should it shoot?

### **Horizontal POI**

I assume we agree that it should shoot straight horizontally. Dealing with off-shooting right or left will be covered later, but, if you see it, the first thing to do is go back another day and see if it continues to happen. And then another day again; this kind of worry can drive you crazy and you might as well find out right away if you really have a problem.

### **Vertical POI**

Where it should shoot vertically is a different question, since it depends on the preferences and mechanics of who is doing the shooting. While what has gone before are technical questions with concrete answers, the choice of vertical POI is a personal one. I doubt anyone shoots very well with a trapgun that shoots below its point of aim, but after we get to flat or higher, there are only shooter-specific answers.

The prescription for determining “your” appropriate vertical point of impact, shooting flying targets from a locked trap, works fine (for trapshooters) but it does not tell you where the gun shoots or where you are shooting it. Just try to find out what works best and go with it. You can settle on where you get the densest “smoke” or best scores or whatever criteria appeal to you.

I personally don't believe in “reading breaks” for directional information but if you do I won't try to stop you. But I do think that you should analyze your minor mistakes. If you are just a little high on a bird a few times and you miss completely, you may benefit from a lower vertical POI to allow you a bit more “upside” error. If unintended high shots result in better breaks, keep that in mind too; you may want to move your POI up a little.

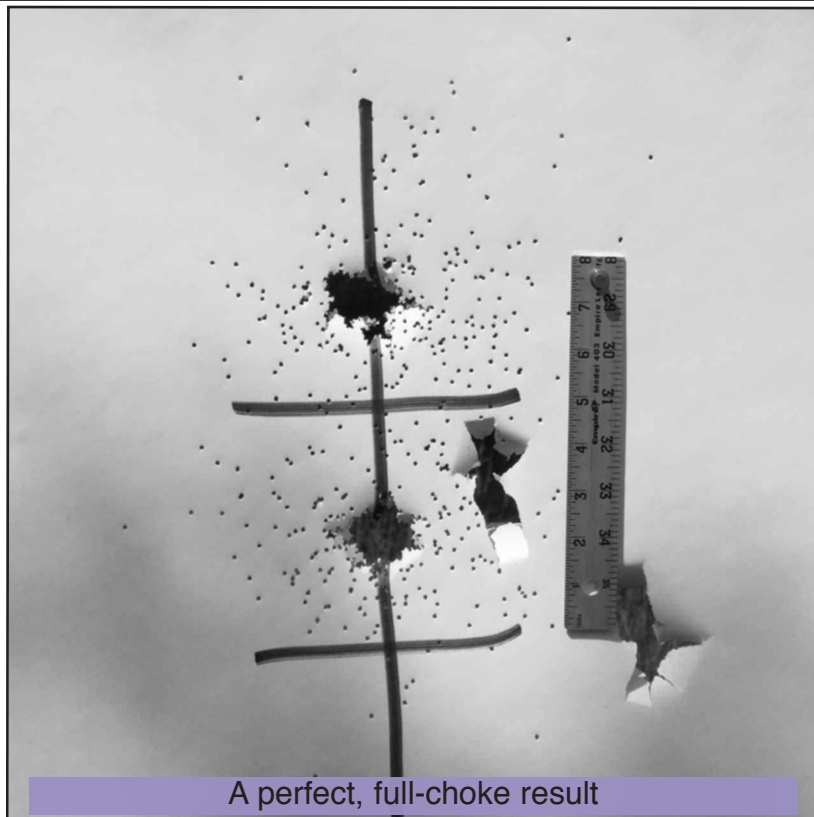
Don't try to match your vertical POI to anything you have read or what you hear bandied about at the club. Why should the way they like to shoot be right for you? And do the advisors there actually know where their own guns shoot or are they themselves guessing?

Don't fall for the macho nonsense “As you get to be a better shooter, you will be able to handle a higher point of impact.” You don't want to “learn to handle” anything that isn't natural for you, and besides, there are plenty of good shooters who shoot relatively flat-shooting guns. High-shooting and high-scoring are not necessarily linked at all. Let your results be your guide and try to leave the ego boost of “shooting a gun like Ray's” out of it.

## SECTION 2

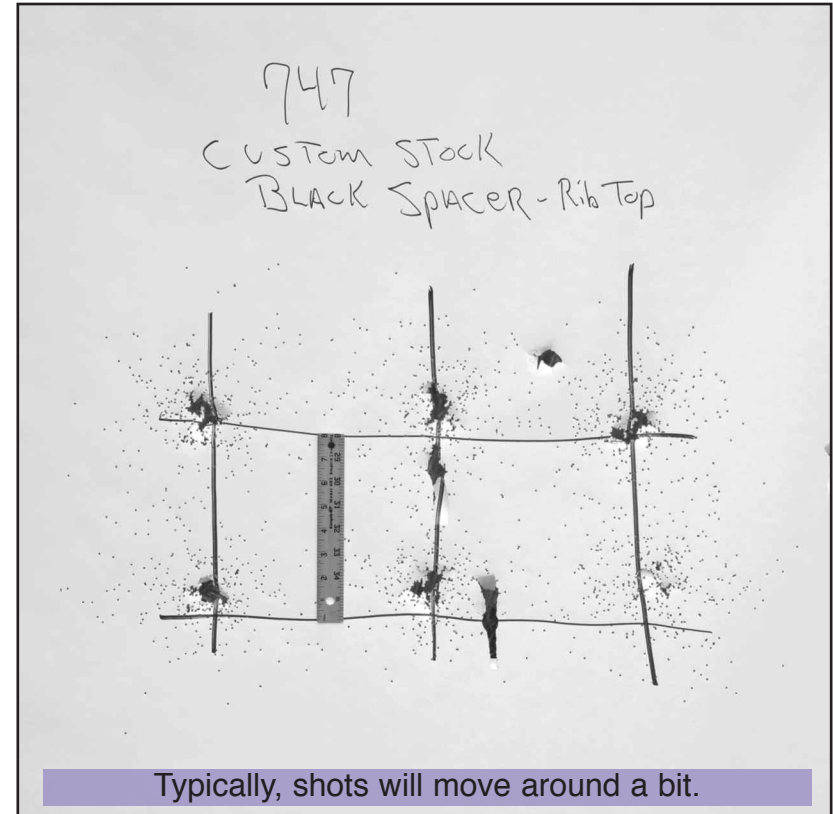
- Typical POI outcomes
- Making adjustments
- What it means at the target

What will the shots look like?



These are the kind of shots you are looking for. They are straight right-to-left and at a reasonable place vertically. Call them 2 ½ inches high at 13 yards and so it's "somewhat high" at the bird.

The other holes are from wads; wad holes can be anywhere. Your own gun may shoot higher or lower; there is no accepted "correct" vertical shot placement other than "what works for you."



This is probably more typical of the results you will get. Again, not the specific placement of the shots relative to the crosses, but rather more shots and some variation not only their placement, but also in the "look" of the impacts. There are also some wad holes scattered around with no particular relationship to the shots that accompanied them. This means you can't guess where you are shooting by watching the wad; it flies independently.

This happens to be about as low as my MX-2000 will shoot. With its adjustable rib and comb, it can be made to shoot a lot higher. In fact, I am sampling handicap points-of-impact three or four inches high (at 13 yards) in recent tests which I think of as "pretty high" at the bird and am starting to like this elevated point-of impact.



### Document your results.

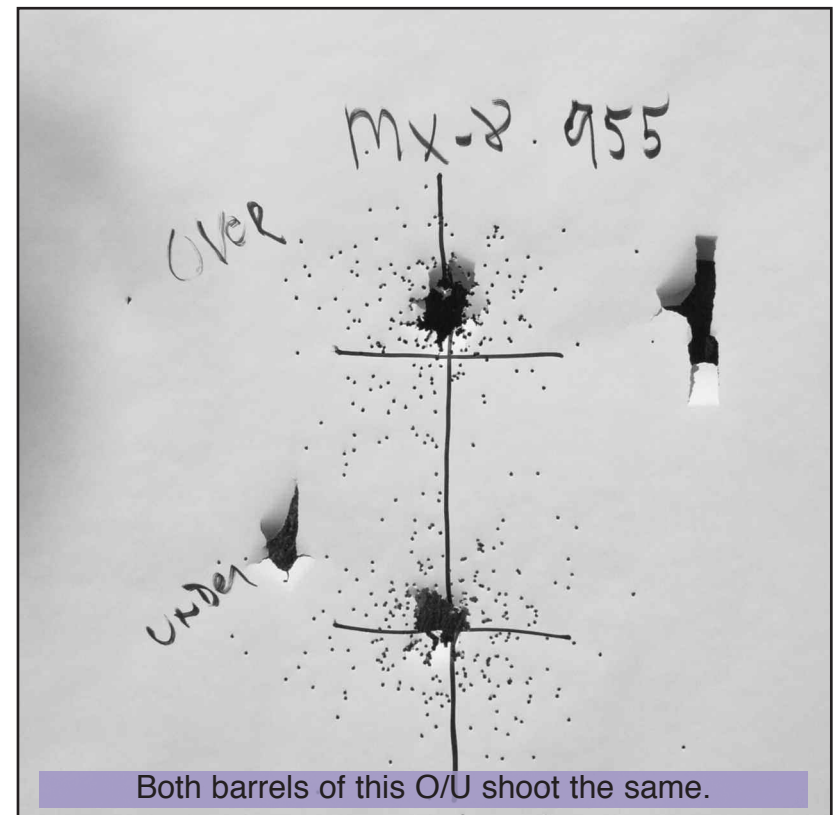
What you see in this report, a series of photos to supplement what I've put in my notebook, can be a help when time dims memory of the details. To make the photos more useful, you can put some added information on the paper itself. A pocket digital camera and a disciplined printing of the images for inclusion in the notebook will clear up the midwinter confusion that often arises about what you really meant.



I might have thought that this, my singles gun, was shooting a bit to the right but the two "Good shot" annotations at the upper left and lower right reassure me that all is still well with it.

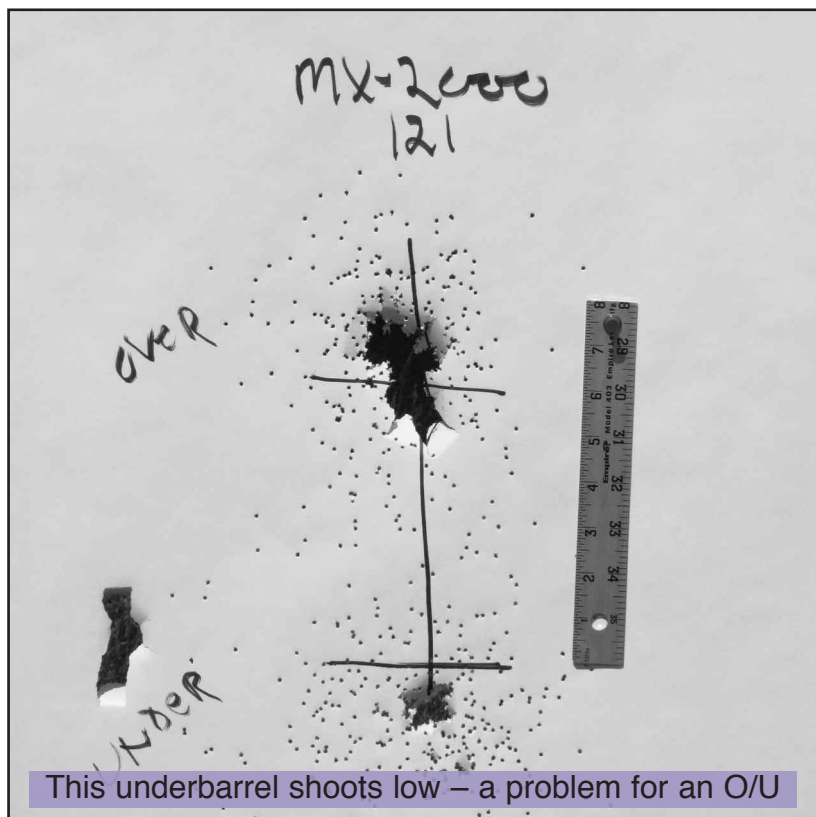
### Testing over & unders' vertical point-of-impact.

I don't know how many times I've endured "An over & under trap-gun is regulated to place the shot from its lower barrel a little higher than the upper one to optimize its use for doubles." What's missing is the introductory "In Camelot" since it is hardly ever true. Fortunate owners of guns with interchangeable, varying-thickness lower barrel hangers, Krieghoff and Kolar for example, can put the vertical relationship between the barrels wherever they want, at least in theory. More commonly the barrels are in a fixed relationship and you shoot what you've got. You may be lucky enough to own this Wilkinson-tuned MX-8 which shoots, it seems to me, perfectly.



By the way, the lower barrel does not shoot a little lower than the other as it appears to do here. It started lower and has risen more than the upper one has at this distance. This sort of gun just shoots straight, both barrels, and is the holy grail of gun-swappers.

It is possible that you have not hit the POI lottery and have something more like this:



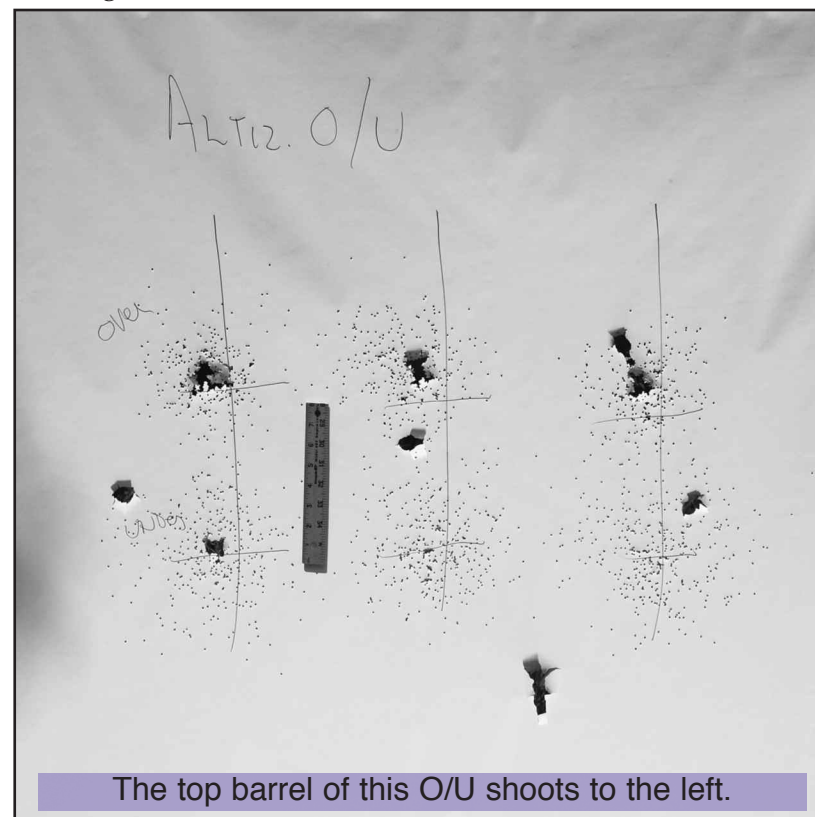
This fault, the lower barrel shooting below the upper by quite a bit, is common enough and such a gun is very difficult to score well at doubles with.

### Shooting to the left or right

Apparent horizontal problems require a good deal more caution. If you think you see side-shooting the first thing to do is go back and make sure you really are looking straight down the gun, exactly centered over the rear of the rib. If you aren't, it's time to fix that.

These results are typical of many guns I've tested. The message is, when you buy a gun, no matter what it costs, you have to test it to see if it is worth investing time in and money on. While most are, there are plenty that aren't. Better to find out now than saddle yourself long-term with a gun that just doesn't have what it takes.

Even though you are carefully set up exactly straight and perfectly centered, guns can still shoot to either side with either tube.



This is not as debilitating a fault as the low/high problem pictured on the last photo. This one probably shoots an inch and a half left (that's four or so inches at the bird) which is too much for my taste, but I remember shooting the gun and it broke birds pretty well.

I've solved problems like these with offset choke tubes from Briley and that firm did as promised and the outcome worked. We will talk about other cures later. I just posted this as an example of what I think is too much gone wrong to be ignored. Keep in mind, however, that it is not proven guilty until it does this several times on different days and it never hurts to have someone else shoot it too, as long as they can get centered on the gun.

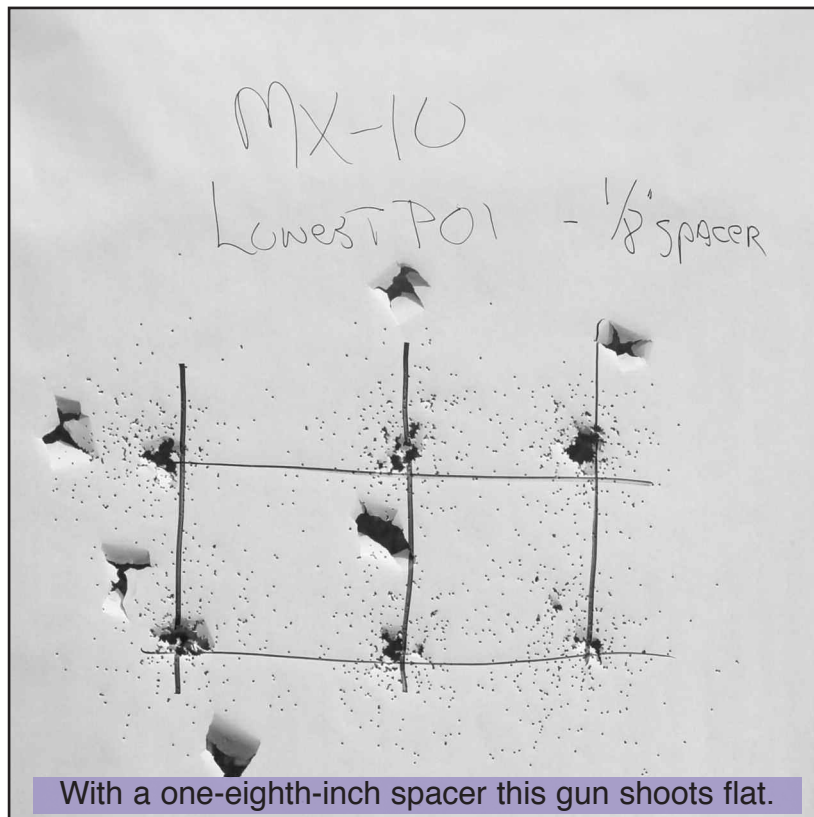
The fix for single barrels is illustrated for the courageous later, in Section 5, Topic 1.

## Making adjustments

Maybe when you got that new adjustable-rib, adjustable-comb beauty it worked fine right off the bat or you were able to get it to shoot the way you want with little fuss. I think it's equally likely, however, that you are still totally lost or worse. You may have come to believe, for example, that it's set one way when in fact it's completely different so when you make changes scores deteriorate even more. Clear your mind with a trip to the pattern board!

### Start with the lowest POI you can set.

Use just enough spacer to see over the rib and shoot to get your feet firmly planted and define a baseline from which you will be able to depart upward in predictable steps should you want to do that. This gun will shoot about "flat" at all usual trap distances



### Add spacers and see what the effect is.

Leave the rib alone at this point; all you are trying to see is what a little more comb-height does to the POI and reassure yourself that the system works, that you see what you expect to, and that you can use it to get any effect you want. After an emergency change on the line you can check what happened just to be sure it worked out as expected, a necessary control on these guns which can slip out of their collars so quickly.

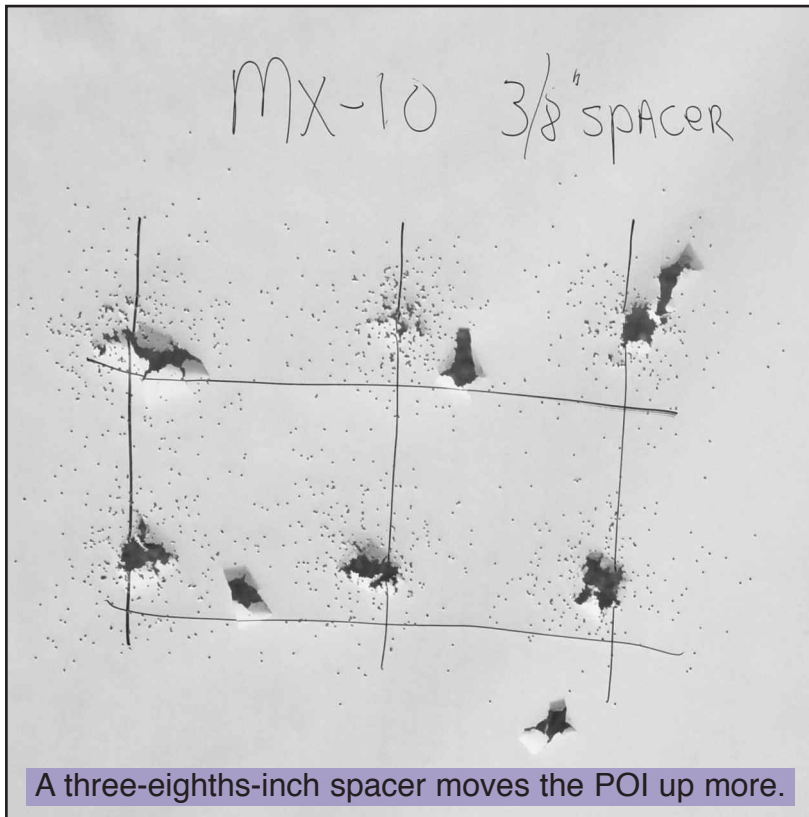
Here's that same MX-10 with a quarter-inch spacer, that is, one-eighth-inch more comb-height than in the previous photo. This gun is now starting to shoot just a little high.



On the average, the POI's here are an inch-plus higher than in the first photo, about what you would expect. Again, what you aren't doing is averaging them, just picking the most prevalent ones and recording the results to no closer than half an inch.

### A thicker comb-spacer raises the POI more.

Put in another one-eighth inch of spacer to raise the comb a total of a quarter-inch from the first photo and you get a gun which now shoots high to about the degree that many like.



Where you go from here is up to you. If you like high-shooting guns you will probably want to try more washers under the comb, or Moleskin® on it, or venture into rib-adjustments if they are available to you. On that journey you will find pairs of settings that cancel each other out, or, conversely, send the shot to unexpected heights. Just keep notes and study the photos.

You may want to work on one variable at a time. I began to get somewhere with my MX-2000 when I set the rib to a reasonable place and restricted my adjustments to the comb to make it less confusing.

Winter evenings are designed for figuring out old riddles and you will emerge in spring with new understanding and also new questions which can only be answered at the pattern board on the warm afternoons ahead of you. I should have warned you – once you start real testing it's hard to quit. And you'll have a new gun to test by then anyway, won't you?

### What do these results at 13 yards mean at trap-target distances?

I doubt many are satisfied with my descriptions of vertical POI placement so far. "Flat," "just a little high," and "high" are hardly what you expected be able to tell the guys at the club. Everyone there quotes percents and cites rising birds and all that. With all the time spent and shells fired you'd think you would have something that will bowl them over, but so far all you have is a few numbers in a notebook and when you tell the roundtable that your gun shoots about two inches high at 13 yards they dismiss you as a greenhorn with little appreciation of the arcana of shotgun technology.

Assuming you don't have something bleeding-edge-trendy like a short-rib Perazzi over & under for Olympic doubles, all you have to do is multiply the vertical POI you see, relative to the cross you were shooting at, by three and you will have about where it shoots at 40 yards, close enough. Thus a shot an inch high at 13 yards equates to a shot about three inches high at 40 yards. If you want to cut it really fine and talk about singles, you might choose two-and-a-half as a multiplier. (Special cases are covered in Section 5, Topic 2.)

That won't help much at a club where all the conversation is about "percent high," but I hope you will stick to what you know for sure and repeat "Two inches high" until they give up. Maybe you will want to go on to "A little high" but that's more ground than I personally like to give. Don't play their "percent" game; it adds nothing and doesn't make sense anyway. Stick with your results; they speak for themselves.

If they want more "science" call it "Five centimeters high." They should take that seriously.

## SECTION 3

### •How choke affects what you see at 13 yards.

#### Example results from cylinder to full

##### What are chokes and what do they do?

Before we look at patterning results let's go over some of the basic information about chokes. While for most of its length a shotgun barrel is a constant internal-diameter tube, most barrels taper to a smaller inside diameter near the muzzle. The tapering section is called the "choke." The tighter the choke, on a continuum from "cylinder" to "extra full," the smaller the pattern the guns produces and the better suited the gun is for long-distance shooting.

There are two choke-description systems, one based on measurement, the other on performance. We will consider the measurement-based system first.

##### Chokes by measurement

The measured degree of choke, that is, the amount of change from the bore diameter to muzzle end, can vary from none (called 'cylinder') to about 0.040 inches (called full or extra full). The choke can be part of the barrel or can be housed in a removable threaded "choke tube" so one of a particular restriction can be easily installed. Typical trap chokes are modified (0.020" restriction), improved modified (IM, 0.025" restriction), light full (0.030"), full (0.035" to 0.040") and extra-full (0.040" and tighter). In general, the tighter the choke, that is, the greater the reduction in bore diameter, the smaller and more concentrated will be the pattern produced by the barrel.

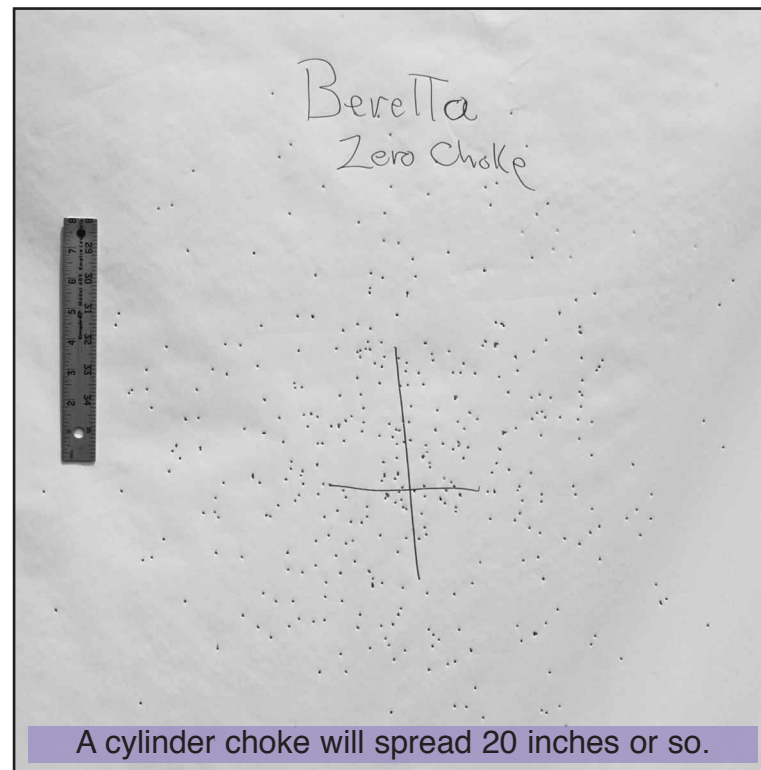
##### Chokes by performance

Traditionally a full choke is one which puts 70% of the shell's pellets in a 30-inch circle at 40 yards, but that description has almost nothing to do with today's shells, when almost any modified choke will do that. The best full chokes today get close to 80% at 40 yards.

The following section links the two standards, measurement and performance, illustrating what you can expect to see at 13 yards.

The following examples can be duplicated only by following the whole program as outlined at the start, using the equipment and setup from Section 1. Use premium factory light 7 1/2's and measure the distance from the muzzle to the paper. If you do this, you can confirm proper shooting – or spot problems – with no added work at all; just look at what you get and you will know not just where but also how tightly your gun shoots. Let's start wide open.

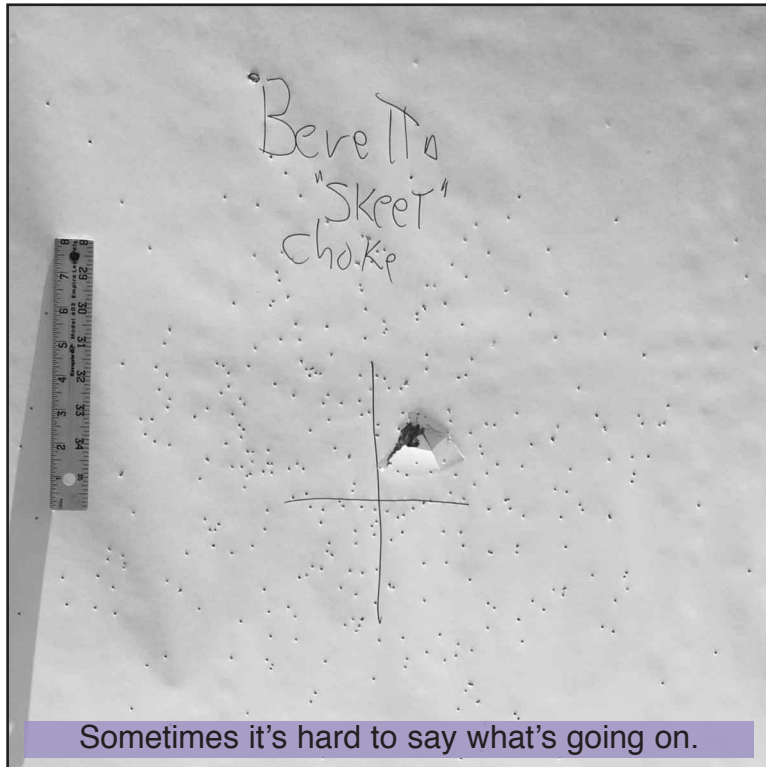
##### Cylinder choke



That was zero choke, also called cylinder. The bore of this gun is 0.723 inches and that's about what the choke tube is too, but, of course, there is a little larger-diameter area followed by constriction where the choke tube meets the barrel bore. So call this "cylinder with a choke tube," leaving open the possibility that a fixed – that is, non-choke-tube – cylinder choke might look a little different.

### Skeet choke

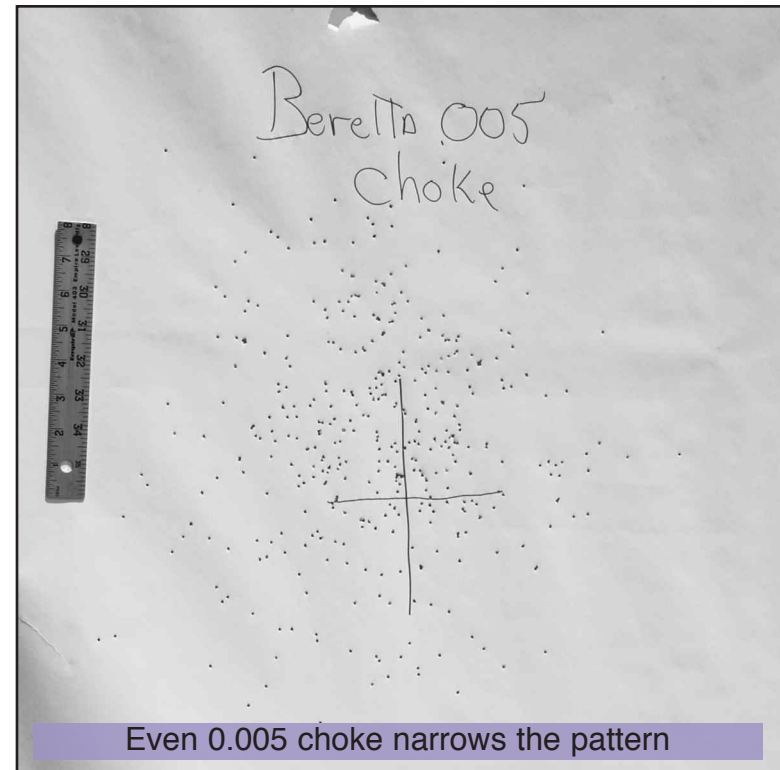
Below is a skeet choke. Most of the following photos of a shot or two look typical to me, but as you test you will see some variation shot-to-shot. Remember those POI tests in Section 2? The photos with six shots from a full choke usually had, along with the expected tight examples, at least one more open pattern, more like IM or even modified. So don't trust just one. Instead shoot quite a few and call one that looks like most of the others a "representative pattern."



I've no confidence that the above is typical for "skeet" at this distance but it's the only example I've got. It looks odd to me; maybe you can do better. When you get something like this, take more shots.

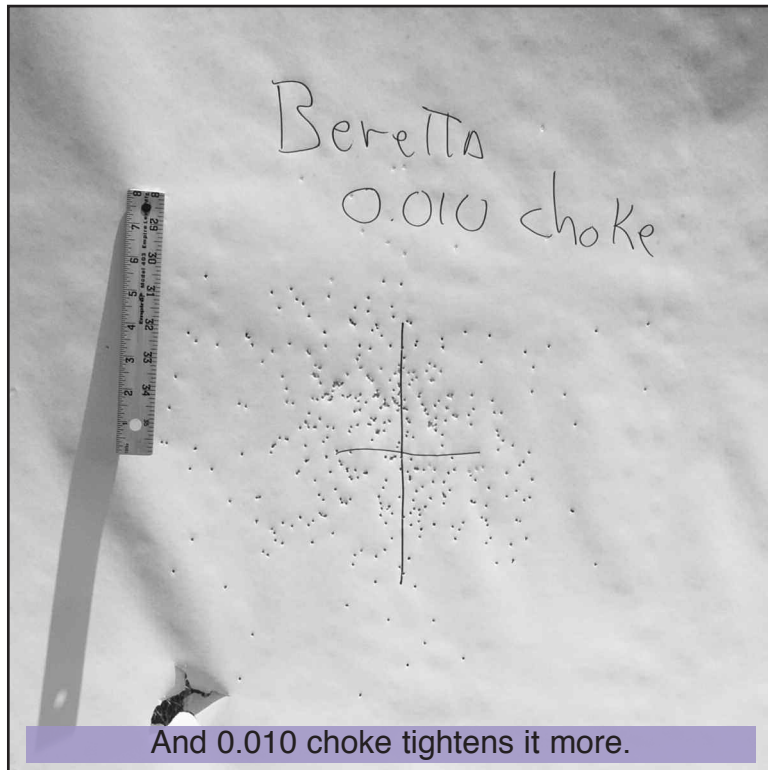
### 0.005-inch choke

Tightening up to even just 0.005 inch constriction begins to focus the pattern.



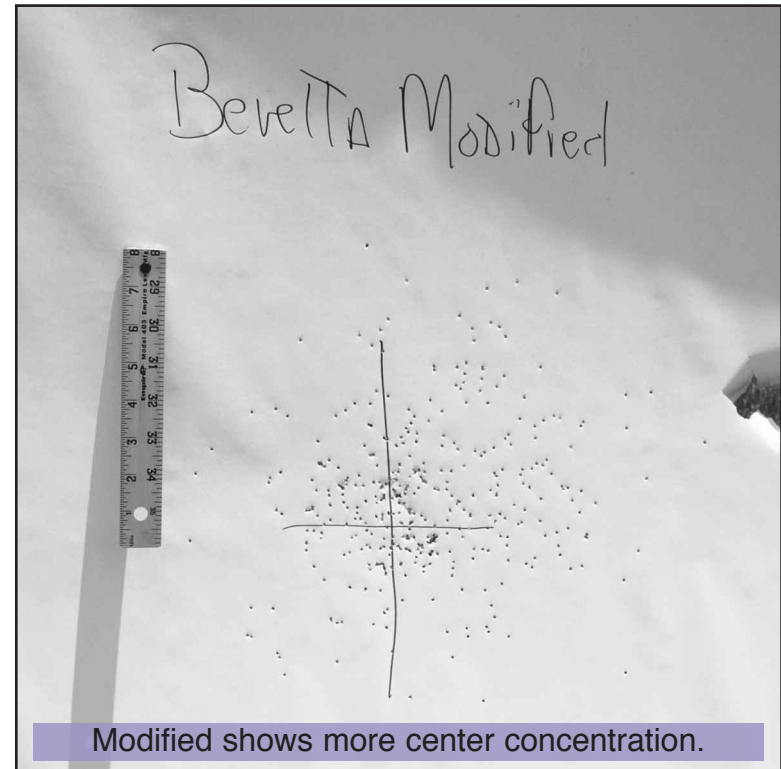
**0.010-inch choke**

And tightening up more to 0.010 inch constriction narrows the pattern a bit more.



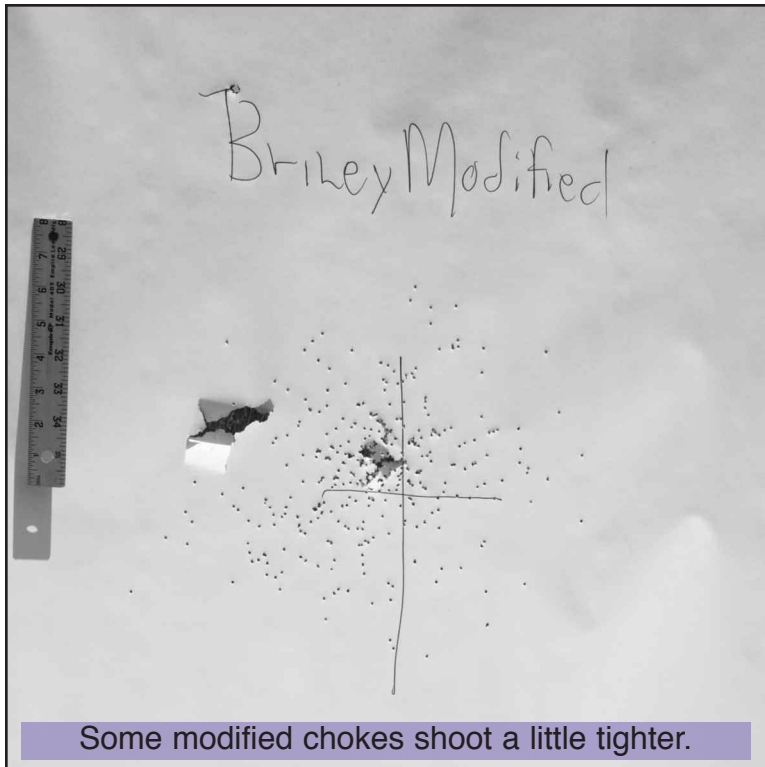
**Modified choke (1)**

Modified chokes are where you begin to get into the range of restriction trap shooters may opt for. Here's a Beretta modified Mobilchoke.



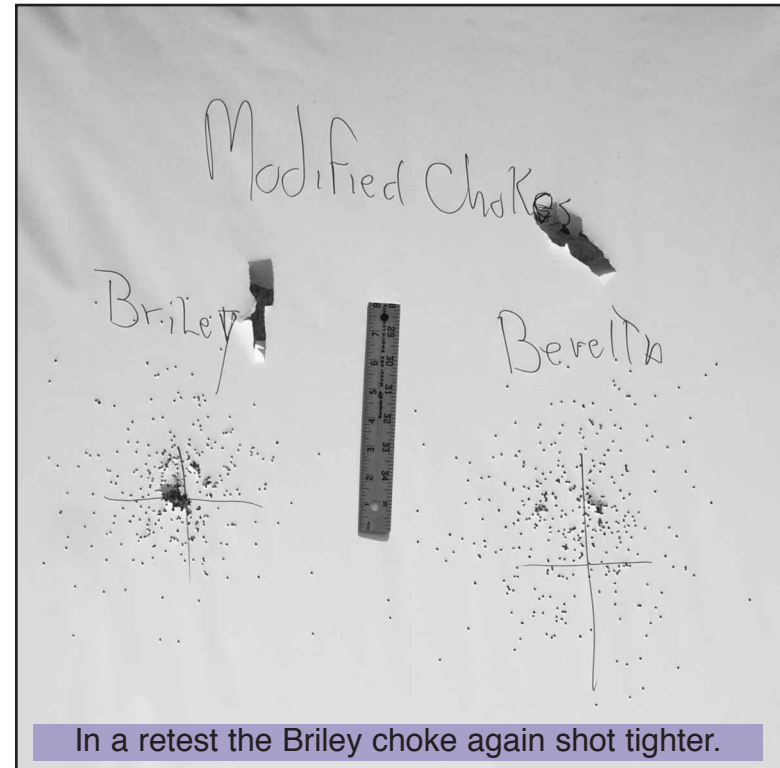
### Modified choke(2)

And here's a Briley choke of the same constriction in the same gun. It looks a little tighter than the Beretta, maybe.



### Comparing two chokes

If you have trouble comparing two similar results, for example the Briley and Beretta modified tubes just pictured, shoot them side-by-side a few times to allow direct comparison.

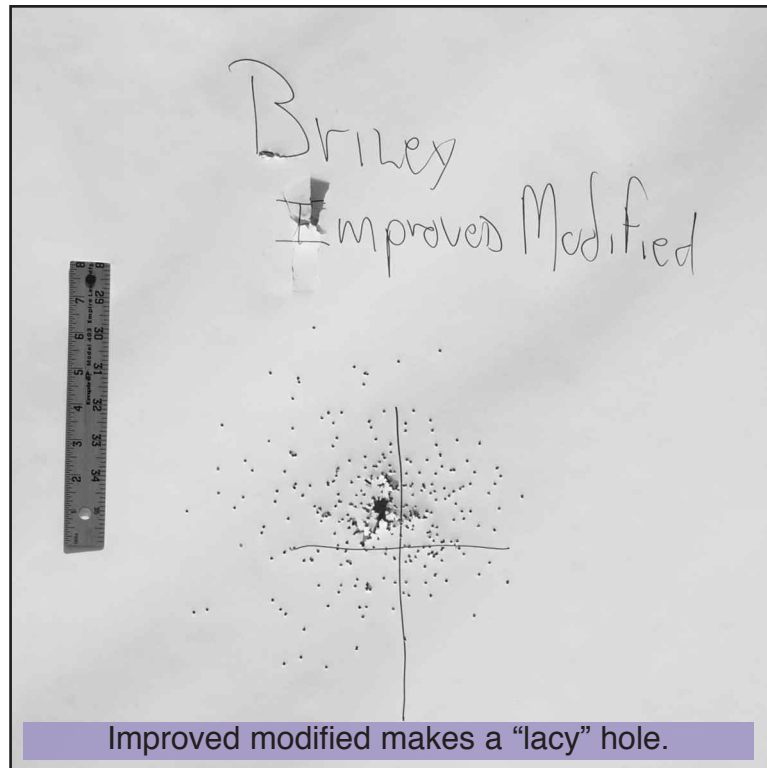


And sure enough, the Briley is making a hole at the center of the pattern at least some of the time, while the Beretta tube does not, producing instead a typical modified "no hole" pattern. As expected, the Briley's pattern is a bit smaller than that of the Beretta in line with its greater shot-concentration in the center.



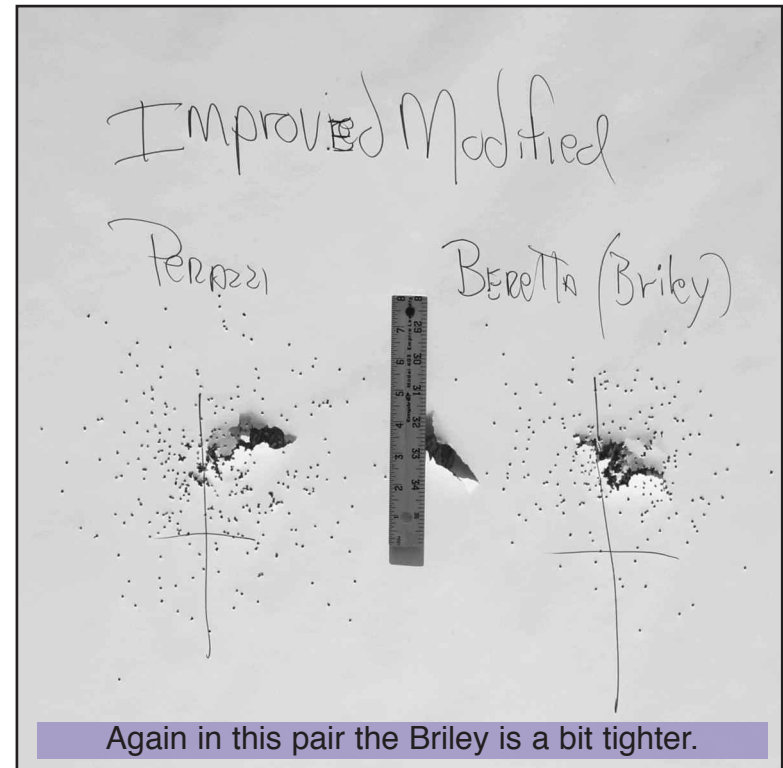
### Improved Modified choke (1)

Improved modified is the first choke which reliably produces a hole with these loads at this distance. But the paper at the center of the pattern is not as "blasted away" as it is with tighter chokes. If you push from the back of the pattern, most of the paper moved out as a result of the shot is still there and can be pushed back in the hole, leaving a "lacy" but fairly complete target.



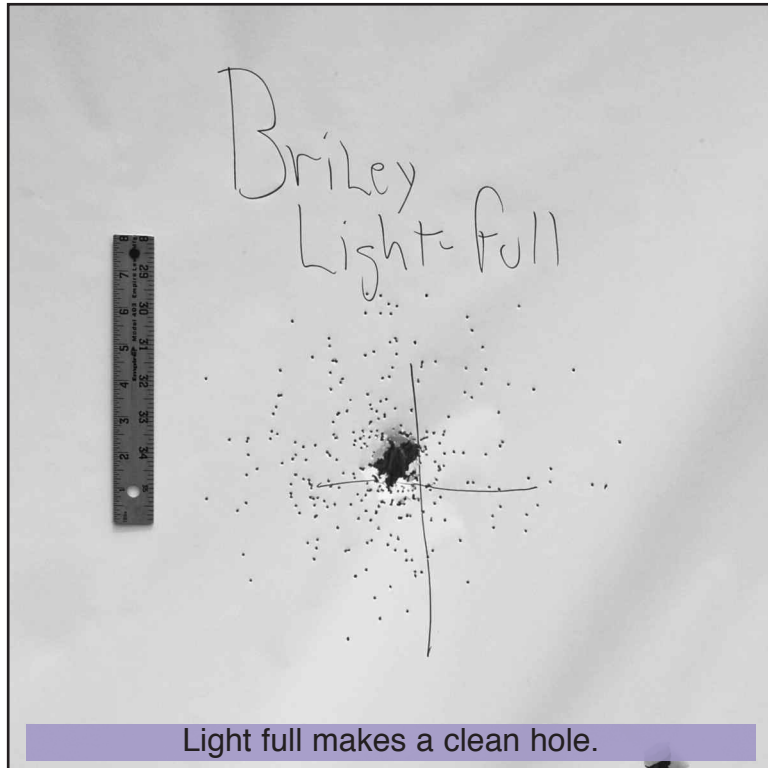
### Improved Modified choke (2)

In this pair, the Perazzi choke tube's pattern is a little more open than the Briley's, in spite of the fact that the bore-diameters and chokes are very similar. This was true for all the Perazzi chokes compared to the two brands of choke in the Beretta 682. As with most IM patterns, the laced paper is still present and can be pushed back into place, almost refilling the hole the shot has made.



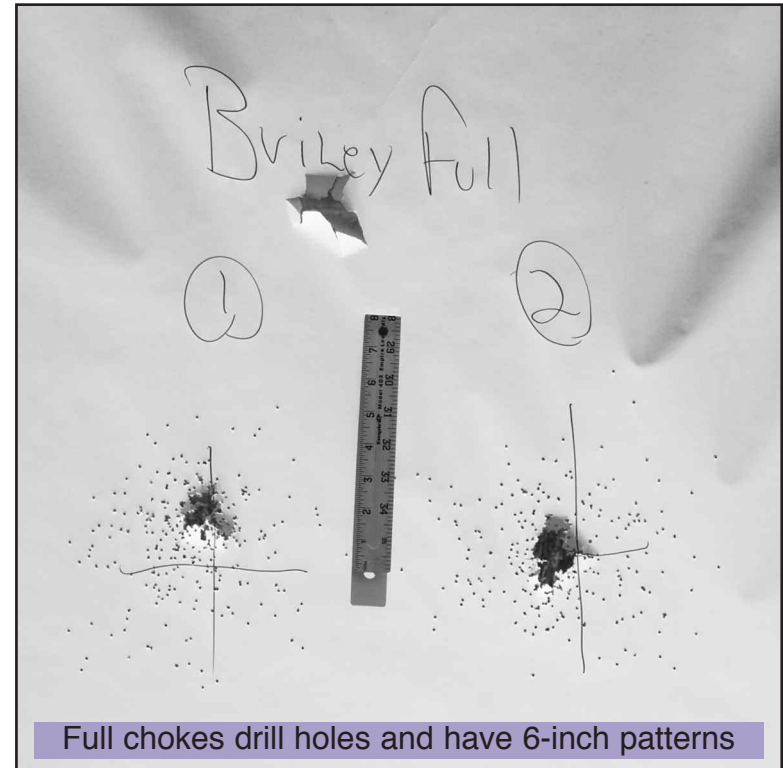
### Light Full choke

Light full is the first choke in this ascending sequence where we will see a clear hole with the central paper blasted away almost all the time.



### Full choke

Similar patterns are shot by full chokes and tighter. The paper that once occupied the hole is entirely blown away; there's nothing left to push back. The pattern itself is becoming more and more concentrated and smaller as the choke constrictions tighten, step by step.



## Ammunition comparisons

You can even compare shells in a general way. This fixed-choke MX-2000 with 0.040 inch restriction shoots premium factory loads very tightly, but economy ammo from the same manufacturer resembles modified or improved modified most of the time.



Thirteen-yard tests tell you not just the point-of-impact of your gun, but how well it shoots different loads too.

I've seen far more dramatic differences than those pictured above from factory load versus economy shell tests. Home-loads too sometimes produce surprises, often disturbing. For example, if you are reloading reclaimed shot you can expect no more than modified performance in this test (or on the trap field) in the best of circumstances.

As you have seen, testing at a measured thirteen yards can not only tell you where your shotgun shoots, but also what kind of effective choke performance you can count on from premium factory shells. It will also let you compare those best commercial loads with what you are getting from the ammunition you generally feed it.

## SECTION 4 Dealing with problems

- Vertical – high or low shooting
- Horizontal – “side-shooting”
- Keep track of what you did

It shoots too low.

**Where does it shoot now; how do you know; why do you think there is a problem; and what change do you propose to fix it?**

Whenever I’m told that a gun shoots in the wrong place, I ask “How do you know?” If the source of the complaint is unable to tell me where it shoots now in inches high, low, or to the side and adds “I set it up as an 80/20 gun using the instructions that came with it, and the good guys all shoot 100%” or some hocus-pocus like that I know he is being guided by gun-club fables, not facts about his own trapgun, and I know I can’t help.

I need useful information such as “It now shoots six inches high at the bird. When I drift a little high on the target it breaks better, and when I am a little low I miss altogether. So I want it to shoot higher.” This is a well-marked highway to better shooting.

You need to know: “Where now?” and “Where-to and why? There are two critical parts to this action plan: 1. The shooter knows where the gun shoots now and 2. Has reason to think that shooting somewhere else might be better.

Without those two elements we can’t speculate about cures for shadowy problems that the gun owner himself is just guessing about. How can anyone “fix” what may not exist at all? Lacking a reasonable plan, aren’t the chances you will just make things worse about 50/50? And how much will it cost and how long will it take?

### Fixing “too low” is easy.

Getting a gun to shoot higher is the easiest POI fix there is. You have to raise the comb or lower the front bead or both. The comb may be adjustable, but if not, there are a couple of things you can do to raise it. Dr. Scholl’s Moleskin® (not Molefoam®– it’s too compressible) is the product of choice. A couple of layers laid on top of the comb but not extending into the face-side of the stock much (for it will move you over as effectively as it will move you up) will make a noticeable difference and it will comfortably cushion your face besides. The Kick-EEZ company makes a product called Cheek-EEZ® which comes in three thicknesses and some shooters are happier with that, saying it is easier on their hide than Moleskin.



### Fixed ribs and the beads.

If you have a fixed rib and raise the comb you are going to see a different relationship between the beads (or just a different view down the rib) than you are used to. You don’t need “stacked beads” to hit birds; you need a gun which shoots where your style requires it to.

Don’t worry about space between the beads, just get used to this new setup. You do not have to check that the beads are lined up horizontally when you mount the gun; if the stock fits, they will be. You don’t have to check where they are vertically either. Assuming proper stock-fit they will be where they should be to break birds and that’s all you have to know.

If you just can’t get over what you see, there are add-on rib makers who can solve your problem, but you still are going to need a stock change so why not just fix your attitude and leave the gun alone and save all that work and money?

Briley can thread your barrel and put in offset choke tubes and many gunsmiths can move your POI any direction you ask (with greater or lesser success), but it's so easy to raise the POI other ways it hardly seems worth it.

Fixed-rib guns which bend the barrel to change POI, K-80's for example, are an exception to all of the above. With them you just dial in what you want and keep the sight-picture you are used to, no fuss, no bother.

### **How much change can you expect?**

As a general rule, a eighth of an inch, up or down, at the comb or the front bead, will show up as a three or four-inch change at the bird. The only thing to watch for is that the comb and bead effects work in opposite directions. Raising the comb raises the POI; raising the bead does the opposite; it lowers the POI.

### **Adjustable ribs**

There is a great variety of adjustable ribs. Some move at the front, some in the rear, some independently at both ends and yet others have a pivot in the middle which means that a change in one end must be mirrored at the other. Just follow the rule that down in front is the same as up in the rear; they both raise the POI. And remember that they add up. In other words 1/8 inch down in front and 1/8 inch up at the rear (with a matching comb-change) is the same as 1/4 inch at either end.

Also keep in mind that just changing the rear of the rib without changing the comb to match it does not change the POI. It's the change in comb-height – the height of your eye, specifically – that does the work; the rib just moves to keep the sight picture the same.

If you are trying to hunt down a POI problem experiment with relatively big changes, at least at the start. If the change is minor it won't effect your shooting enough to tell better from worse, and you will probably just move your head a bit to bring back the view you are used to anyway. You can make the finer adjustment later but at the start you are just searching for "better," not "perfect." That comes later.

### **Bending the barrel up.**

With a single-barrel, there's always the option of bending the barrel upwards to raise its point-of-impact. B-Square® made a tool to do it but for every one done that way there must be a hundred fixed using the simple and economical technologies which have stood the test of time, that is, forked trees, fence posts, shot bags, vises, bumpers, whatever can be used as a fulcrum and whatever can be used to apply a force.

If you don't have an adjustable rib and don't want to make or buy an add-on one, this may be the only way to get what you want. You can only raise the comb so far before you lose the impression that you are sighting down the gun and the feeling of pointing it goes away.

You run the risk of kinking the rib unless you use the B-Square® tool, so if cosmetics are important to you, you might get or borrow one of them or send the gun to someone whose work you trust. But if you decide that how it looks is secondary to how it works, you can just bend it and it will stay there as long as you go a bit too far and then drift it back just a touch. Done that way, it won't revert back to where it was or be unusually heat-sensitive or anything like what you might have heard.

## **Cures which are not likely to work**

Since changing the gun is always at least some work and often incurs expense too, every shooter is tempted to first try a "software" approach, that is, to learn to live with a gun that really doesn't suit him and his shooting style. In most cases he is just delaying the inevitable, but there's no harm in trying, if only to reinforce his determination to get serious about fixing it when he finally gives up shooting it the way it is.

Shooting above the bird does at least put the shot where it should be, but it's hard to judge how much over the target you should shoot and it's even more difficult to do it consistently. All in all, it's better to fix the gun, though it's certainly worth trying a few rounds of experimental "shooting high" before you extensively modify the gun, if only to see if you have analyzed things correctly.

“Holding lower on the house” (or in any new place) is often suggested, but since the problem is the gun’s POI, not where you point it well before you shoot, anything that may improve by doing this is probably just chance and will go away as soon as you get used to holding in the new place since the gun itself will continue to shoot too low.

Putting on a smaller bead won’t help; no one needs a half-inch change in point-of-impact.

I’m sure there are other suggested fixes I haven’t heard of, but you should approach them all with the question “How much will this move the POI of my gun up?” If the answer is little or none, try something that will do what you need instead.

## It shoots too high.

### **Shooting high can be a tougher problem to solve.**

Unfortunately, correcting high shooting is not always as easy as just applying reverse english to the advice on the last two pages, since it’s common for mechanical constraints to spoil your plans.

### **Working with the rib**

If the rib is adjustable at the muzzle end, that’s the place to start by raising the front bead. You may get all the adjustment you need there and be happy with the result. But if it still shoots too high or the rib isn’t adjustable you have to dig deeper.

How high-shooting is cured depends on how much rib the shooter sees looking down the gun. If he sees some rib, maybe even some space between the beads, there is hope that there will be a relatively quick fix and it won’t be too expensive.

### **Working with the comb.**

If the comb is adjustable, remove some spacers and see if it gets you where you want. If the comb is not adjustable, or you have dropped it all the way down and it’s not enough, you need to calculate before you do anything rash like bringing out the rasps and going to work.

Only if you are at least somewhat above the rib will reducing the comb height work for you. If you are straight down the rib now with the beads practically lined up, sanding the comb will cause you to lose sight of the barrel and leave you just looking at the back of the receiver. In other words, this is not like moving the POI up where you can see as much rib as you like; going down there is a limit, that being the point at which you no longer see the rib at all.

### **Bending the barrel down.**

If the barrel is bent up now and that’s why it shoots too high, just bend it back down. But if it is straight now, then bending it down probably won’t work since, like lowering the comb too much, you won’t be able to see the far end anymore.

### **Add-on ribs**

It may be that an add-on rib is your only solution but that is far from an easy fix. What’s needed is an “up-taper,” that is, more height at the muzzle than the breach. You can easily make your own from balsa to see how it works or just contact someone like KeenSights® and trust their expertise. You have to change the comb-height too, so that’s more money unless it is already adjustable.

## Cures which are not likely to work

I’m sure someone is going to suggest a bigger bead, but that’s not going to change enough to matter. A bead mounted on a block has worked for some people, but I think that your shooting relies on the whole picture – the gun, the rib, the bead, everything, especially when you have to make an unexpected move to an errant target. Are you going to have the presence of mind to hunt down not just the bird but also find the bead-on-a-block and put them together just right in a hurry?

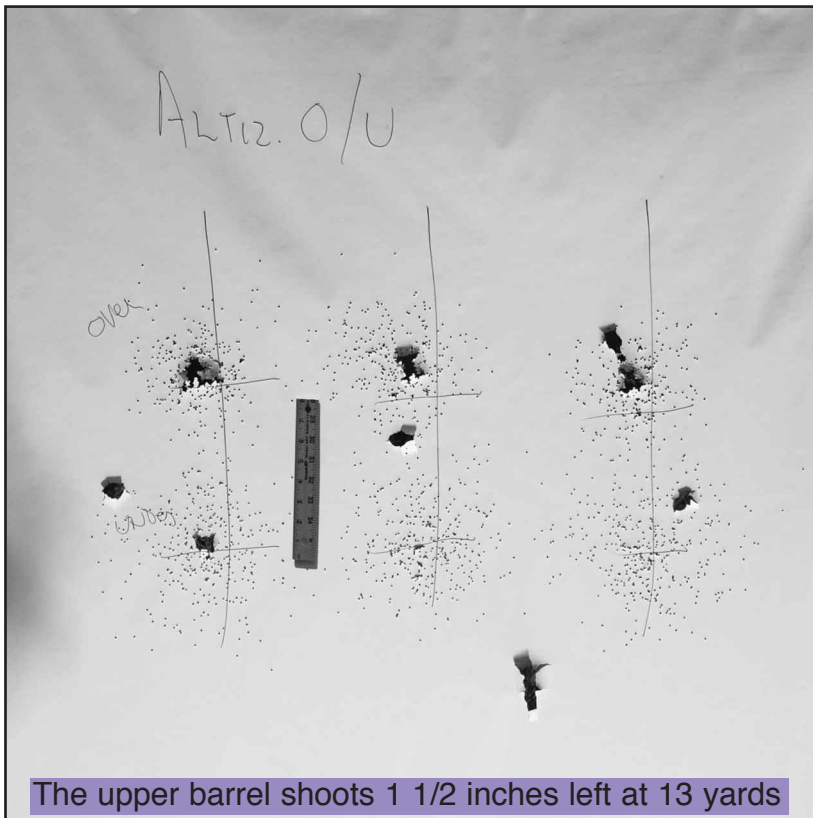
You can just learn to shoot farther under the target and make that work almost all the time too. But I find it exhausting, all that careful aiming, shot after shot, and by shoot-off time I’ve little left. And isn’t it more natural – and reliable – to shoot *at* something rather than under it?

I'm sure there are other things you will hear or read about as well, but I suggest you approach them all with the same question you asked about cures for low shooting. "How much will this move the POI of my gun?" If the answer is little or not at all, try something that will do what you need instead.

## It shoots to the side

### How much is too much?

A little shooting to the side is tolerable, though straight is better, of course. If a full-choke hole touches one of my aiming lines though not centered on it, or even closely abuts it, I call it "straight" and don't worry any more about it. But an inch and a half off is too much for me and that's what this top barrel looks like:



Keep in mind that no gun can be convicted of off-shooting until it shoots to the same, wrong place in several test-sessions over several days. But lots of guns don't shoot straight right-to-left and it's better to find out now that you have one rather than wait until you quit trapshooting in frustration. But let's go over the whole program one more time just to be sure we have it straight.

You are shooting off a rest, right? Are you really exactly centered on the rear of the rib? When you get a result like the one on the left, reshoot it several times. Does it repeat the next few times you test it? If so you have to fix it.

### How to fix side-shooting

If this were a single barrel I'd just bend it to shoot straight, but since it's an over & under, that option is foreclosed, at least to me. You can grind on the choke or use reamers at an angle, but I think the best solution is carefully documenting what sort of POI change you need and sending the barrels to Briley for offset choke tubes. They will come back shooting where you specified, so make sure you know for sure what you want.

There are people who would offset the comb to fix the problem pictured on the left, but I wouldn't consider it. To get this right you would have to offset the comb about an eighth of an inch which looks all wrong when you shoulder the gun. I actually tried this a couple of summers ago to see if an MX-2000 could be rescued without using force but it never worked for me at all. Confidence is part of shooting well, and asking yourself "What the hell is this?" every time you mount the gun makes you think you will never hit anything and so you don't.

I've never understood offsetting the comb for any other reason than centering the eye on the rib, and you can do that at home not shooting at anything. But I read that desperate people do it all the time to move patterns some unknown distance based on target-breaks or worse. Some people even recommend it! It just makes me wonder why someone would spend thousands to pursue a sport but not invest a mere hour to find out the most basic information of all, where the gun shoots.

## Checking and keeping track

**Check your results. When you change something ask yourself “Why did I do it?” and “Did it help?”**

After you make a change and want to decide whether it had been a good idea or not, your notebook should remind you when and why you did it, what the change worked out to be on the pattern board, and what the result was in the real-life arena of shooting targets.

A bad round can shake your confidence in your equipment. Rather than trying to find a POI you have misplaced by shooting in an event, first go back to the pattern board and get your thinking straight again. Your notebook can be a big help especially if you have taken the time to include some pictures.

Evaluate emergency mid-event gun changes afterward at the pattern board; there's plenty that can go wrong on a frustrating day on the firing line and you want to be sure you didn't get it backwards as is so easy to do. In time, let's say over the period of a month or two, you should have the gun shooting about where you want it to and so be ready to shoot the rest of the season with confidence. You will also have the knowledge and equipment to make further changes – should they be called for – as your skill and shooting style evolve.

Good luck and good shooting!

Neil



## SECTION 5 Miscellaneous Topics

- Bending a single barrel to shoot straight
- Calculating 40-yard POI from 13-yard data, special cases

### Miscellaneous Topic 1: Curing POI problems by bending

#### How do you know it's not shooting where you want?

I hate to keep pounding on this, but it is, after all, the entire subject of the last 24 pages. I'll give you the answer: "You know it's not shooting where you want if you know where it shoots now because you have followed the plan outlined here exactly and in every detail. . . ." And the second half: ". . . and you have reason to think another specific POI would lead to better scores."

I'll also give you some wrong answers: "The guys at the club say I'm shooting behind them." "I'm getting better and so need a higher POI." "Most if my chips fly left." "I speeded up the lock-time on my gun and so need a higher POI." Of course, that's only a sampling, but anyone who would bend a barrel based on ideas no better than those deserves whatever he gets even though we can never predict what it will be.

I think an example will tell you enough to enable you to adapt a similar plan to your own situation. Here's a post I put on Trapshooters.com on the 30th of March, 2010.

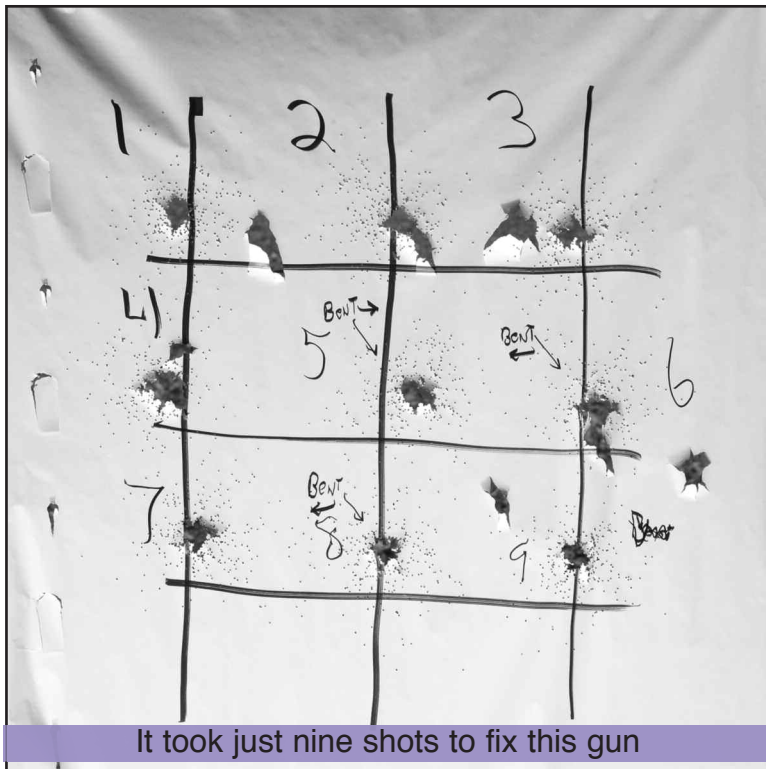
#### Bending a gun to shoot straight.

I have had a like-new Ithaca-era MX-8 single for seven years and POI- and pattern-tested it many times and it's shot a little to the left all that time. This is typical not just of Perazzis, of course, but shotguns in general. Many don't shoot straight. Dr. Jones' POA calculator (<http://www.shotgun-insight.com/POACalculator.html>) showed me just how unsatisfactory was a three-inch to-the-side deviation at 40 yards (the projection of one-inch to the side at 13 yards).

I'm trying to get used to an MX-2000 and wanted to have an "old time" good shooter to compare it with, so it was time to slap this one into shape. I suppose many here would suggest moving the comb over and it does in fact have one of the last Gregg Hissem combs, but that's never made any sense to me. I would be looking crooked down the gun and as I went for the shot, I'm sure I'd move my head over to look down the gun as was intended.

So I just bent it until it shot straight and I could still look straight down it. It couldn't be easier and took maybe ten minutes to turn this gun into a potential shooter.





Narrative:

Shot 1, An inch left, typical of this gun.

Shot 2, Straight, but not all shots are correct. That's why you take a lot of shots over several days before you do anything.

Shot 3, An inch left, typical of this gun.

Shot 4, An inch left, typical of this gun.

Shot 5, After bending to the right. Too far, that's for sure.

Shot 6, After bending back to the left, still too far to right.

Shot 7, Confirmation of shot 6.

Shot 8, After bending more back to the left, just right after seven years of shooting crooked.

Shot 9, Confirmation of shot 8.

Of course, I'll retest it many times when I am down at the pattern board with other projects just to make sure. I'll be realistic enough to tweak it a bit if called for, though in my experience, straightened guns stay straight.

### Equipment used

Oh yes, I used a precision jig for the bending. That's the only cost of the whole project – getting the equipment resurveyed and recertified each spring to account for changes.

Here's the whole apparatus:



And here's where the action takes place:



Really, that's all there is to it.

## Miscellaneous Topic 2:

### Calculating 40-yard POI from 13-yard data, special cases.

#### Why calculate this at all?

While it's nice to know, for example, that your gun shoots 10 inches high at 40 yards, it's not a datum I've ever found much use for beyond speeding the transition to a new gun, that is, a ballpark place to start with something unfamiliar.

There's no point in trying square what you get as POI above the aim-point with calculations of "bird rise" in the interval between firing and the shot contacting the target. You are almost certain to get the calculations wrong the first few times you try it and besides you are just guessing about the two most important variables, how far the target is away when hit and at what angle above the horizontal it is flying. So how much faith can you put in the answer?

There's similarly no point in getting the figure so you can translate it into "percent high," a truly regrettable flight of fantasy few shooters seem able to resist. Just stick with a description in inches and you will be fine.

The easy way is good enough if the guns are similar.

In Section 2 I wrote:

*Assuming you don't have something bleeding-edge-trendy like a short-rib Perazzi over & under for Olympic doubles, all you have to do is multiply the vertical POI you see, relative to the cross you were shooting at, by three and you will have about where it shoots at 40 yards, close enough. Thus a shot an inch high at 13 yards equates to a shot about three inches high at 40 yards. If you want to cut it really fine and talk about singles, you might choose two-and-a-half as a multiplier.*

#### What would lead us to trying something more precise?

And that remains true, but you may in fact have something really unusual. Or perhaps your intent is to set the POI's of two guns of vastly different design to be the same.

Or maybe you are just confused by your O/U which looks at 13 yards like it shoots in a slightly different places but on the field seems to shoot top and bottom exactly the same. For those cases we might want a more precise method of calculating 40-yard points-of-impact based on data from shorter ranges.

But first permit me a digression into the subject of precision of measurement, a digression which I hope will keep us from deluding ourselves about the precision of our POI descriptions and, in consequence, the downrange estimates which arise from those descriptions.

#### How precise are the measurement we are working with?

Remember how we determined our 13-yard POI on page 4 of Section 1? We do not calculate a "mean," that is, sum all the distances above the aim point and divide by the number of measurements we made (though I've seen it done on TS.com to the extent that a POI was expressed to the hundredth of an inch)!

Instead, we just select one of the POI's which we have called "good shots" from a group of others in about in the same place, and express its location to the nearest half-inch, that is, 3 inches high or 3 ½ inches high or whatever it happens be. In such an example, "3 inches high" means "more like 3 than either 2 ½ or 3 ½." Said another way, "more than 2 ¾ and less than 3 1/4."

That means that at 13 yards we make no distinction between any measurement between 2 ¾ and 3 ¼ inches high, which further means that when we the triple the distance to 40 yards, we make no distinction between about 8 inches and about 10 inches high.

All that was just to explain why we are not going to do these calculations to the fraction of an inch, but rather to about the nearest convenient inch or two.

#### Preliminary measurement: Bore center to bead top.

OK, let's consider shots from a full choke which center two inches above the point of aim at 13 yards. How did they get there?

They started somewhat lower, at the mid-point of the bore diameter to be exact, and climbed to two inches high. To find out what this means, in vertical distance traveled, we need to measure the distance between the top of the bead and centerline of the bore.

For 870's and similar, it's  $\frac{3}{4}$  inch. For the top barrel of my MX2000, with the rib adjustment at the top, it's  $1\frac{1}{2}$  inches and for the lower barrel it's  $2\frac{1}{4}$  inches.

The calculations:

Let's do this Perazzi's over & under barrels, beginning with the top one. On the way from the gun to the paper, the shot rose from "minus  $1\frac{1}{2}$  inches" to "plus 2" inches, a rise of  $3\frac{1}{2}$  inches.

On the way to 40 yards (39 to be precise, but 40 is close enough) it will rise twice that much above where it is now, so it will rise 7 inches more. Add the 2 inches high that it is now at 13 yards, and you would expect a gun which shot 9 inches high, but gravity steps in and knocks  $2\frac{1}{2}$ \* inches off that figure and leaves you with a gun which shoots about 6 or 7 inches high. This is, for all practical purposes, the same as multiplying the 2 inches high it shoots by 3 as I did in the simplified formula.

The bottom barrel starts at "minus  $2\frac{1}{4}$ " and getting to "plus 2" rose  $4\frac{1}{4}$  inches. Double that to  $8\frac{1}{2}$  and add the 2 inches high it is now and expect  $10\frac{1}{2}$  but subtract the  $2\frac{1}{2}$  inches for gravity and get a gun which shoots about 8 inches high. So it makes little difference in average cases like this but with the super-high ribs I see on the line these days it might be worth taking into consideration, especially if you plan to match one of those radical new guns to a more conventional arm you have been shooting up to now.

\*A simplification to account for the effect of gravity at 13 yards, where it does its work too, of course.