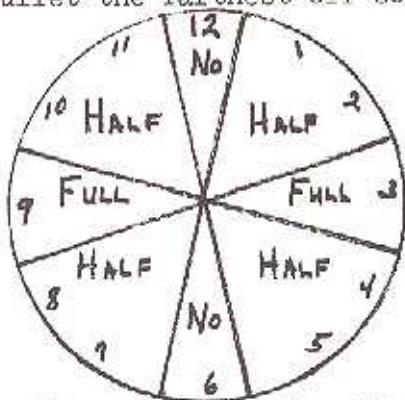


EFFECTS OF THE WEATHER

Margaret Murdock

I'm going to start with the basics, even though I know most of you understand these for the most part. This way I'll be sure we're all starting together, and then I want you to ask questions so we can work with the problems you're having. The two major things you have to worry about when you're shooting outdoors are the wind and the mirage. Some people think they always work together - they don't. I'm going to talk about wind first, because when you're shooting 50 meters international that's the most important thing to keep track of. If you shoot American prone, the mirage becomes more important and always with high power it can be the major factor. But in international, where you have wind flags down-range, the smartest thing you can learn to do is really read wind flags. At 50 meters, you can't read the mirage closely enough, but you can see everything that's happening on your wind flag ninety percent of the time.

First, I'll cover the wind values. If the wind is coming straight in from the right or the left on a horizontal plane, it's called a full value wind; that is, it's going to blow your bullet the farthest off course that it can.



If it comes in at an angle it won't be worth quite as much, thus it's called a half value wind. You've probably seen the high power formulas for these winds as being so many clicks, but it doesn't hold quite true for smallbore. If it's coming in from behind or in front, some people think it makes a great deal of elevation. On most ranges, the most a head or tail wind will be worth is one to two clicks elevation at 50 meters in a stiff wind. We'll talk about Black Canyon a little later as it is an exception. Dave can add his experience too - he reads the wind longer than anybody else!

DK: I learn less every year.

MM: When you watch your flags, it's not enough to know just whether the wind is coming from right to left or left to right. You need to know if it's coming from three to nine o'clock or four to ten or five to eleven. When the wind is half value, after having been full value, you need to take off some of your windage. On smallbore rifles, wind does not move your bullet straight across the target from right to left because the bullet is spinning. It will go at an angle something like this.



bullet will go down and right. If it's coming from the right, the bullet will go up and left. This means in order to compensate for the wind, you must take clicks on your elevation knob as well as your windage knob. Figuring out the ratio of clicks of elevation needed in relation to every click of windage is the important thing. This helps you when you've been shooting basically in one condition all day and it suddenly changes direction. On the range we all learned to shoot on at Fort Benning, we took three clicks of windage for one click elevation. Sometimes, you take even more than that here - the ratio is one to one. It depends on direction and velocity. That's the secret, that's the experience, and I don't know how to tell you when to decide to do this. When a big hunk of air falls off the roof, as Writer said, that's when you take one to one. Anyway, be aware that the bullet never goes straight across your target from nine to three. If you're shooting prone with a scope, you can see this very well. So when Writer says he's shading, he means from four to ten, or five to eleven. We never shade on the horizontal from three to nine o'clock. Now about the wind flags.

DK: Which flags do you believe on the 50 meter range? Do you use the close one, the midrange or the one nearest the target.

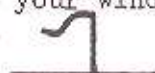
MM: This range has more flags than most. Generally, you can say that the flag closest to you is worth more than the flag farther away. So here at Black Canyon keep a close eye on the near flag, particularly for direction. It's worth more than the one near your target. You can let the two flags downrange move quite a bit here before it will move you out, as far as switching from full value to half value, and sometimes even complete direction changes on the one close to the target box. If the midrange flag changes direction, you better stop and reconsider before you shoot. Also, on enclosed ranges, the wind will often swirl. It will come in and make a circle between you and the target. That means the wind is going one way downrange and another way at close range. Watch the closest flag and put the main emphasis of your wind reading on it. The far flag will then either compliment or decrease the effects of the close flag.

How do you decide what condition to shoot on? Personally, I hate to shoot when the flag is just hanging there dead. This range is one of the worst in the world to try to shoot on a so called "nothing condition." There is never a time on this range when "nothing" is going on. You're better off to pick a condition you can actually read. The nicest condition, and one which I like, is when the flag is blowing out between here and here.



If you get this nice

condition and it's steady, watch your wind flag so you can shoot and keep shooting. Then a pickup comes along. Sometimes this will blow your flag out straight and it will stay straight which is usually okay. You can shade a tiny bit or take a click and keep shooting. When you see your wind flag, instead of just blowing out steady, starting to hump out like this



and the end flips higher and

higher until it gets out straight, I suggest you wait. This has always been a disastrous condition for me. It's picking up, but I can't tell how much it's going to pick up. I usually don't shoot when the wind is getting noticeably stronger, because I don't know how much stronger it's going to get before my bullet gets down there. I usually try to catch it when it starts back down after a pickup. It doesn't usually stop just suddenly, but it seems to pick up more quickly.

As far as hot weather and cold weather, it seems sometimes the wind will be worth a little bit more in cold weather, so that each change is worth more and you will need to take a click sooner than you would when the temperature is 70 to 80 degrees. In the rain, when the wind starts barely blowing and your shots start going out, you need to remember the air is heavier when it is raining. During and after a rain, the wind flag is wet, which means it will take more wind to get it out to the same point as when it is dry. Thus, even though the wind does not look any stronger than before a rain, it will blow the bullet farther off course.

RF: What do you do after a rain, when your flag is so wet it isn't registering the wind, and the sun hasn't come back out so that you can read mirage?

MM: You can usually begin to see mirage before too long. However, just after a rain is sometimes a good time to shoot, because it is very calm. If you can get back to a sighter, shoot a couple to see if the dead calm is going to hold and then you can get off a lot of shots fast while it is calm. That's how Writer beats us all - he can shoot a lot of offhand in a five minute calm, while the rest of us may only be able to shoot two or three shots in that same five minutes.

BW: If you've marked your zero, you can take off all your windage and shoot from zero.

DK: That's good advice, and most smallbore shooters don't take advantage of zero.

MM: Do you all understand zero? It's knowing where your sights are centered at no wind. You need to check this over a number of days, then mark it with a magic marker. This way you can remove the mark with Hoppes if you change your mind. Your zero will probably be different for each position and each new range.



EA: What do you do when each wind flag is going a different direction?

MM: It is really pretty difficult to attempt to find a zero on a day when the wind is switching badly. Try to find your zero on a calm day, when the wind is coming in from the back or front, so that you only have to take a click one way or the other when it shifts from left to right. Basically you need to use a number of other wind indications, as well as your flag, which can be used as checks on the wind flag you are primarily watching. It's important to figure out what is happening on a new range and to do this you must watch a number of things - the dirt, the grass, the trees, the smoke from another competitor's rifle - notice everything you can. Make every sighting shot count. After you get into position, and after you have held your rifle and have dry fired until your position is squared away, then take your first sighter and make it worth something. When you shot that shot, know what the wind flags are doing and everything else you can find to watch. Take your full correction, if this is the condition you plan to shoot in. Then, instead of using all your sighters in this condition, shoot some when it is going the other way. Try two or three conditions and know where you are from zero, so if you find your condition is no longer there and won't come back, you have some idea how much windage and elevation to take so that you can shoot in the second condition.

There are several ways you can handle the wind. You can choose just one condition and wait for it to return for each shot. To do this you'll be in position a long time and you'll need to be extremely patient. If you're on a range someday that you just can't figure out what's going on, it's an excellent way to shoot. Another way is to shoot your shot and chase, but you must be able to shoot fast to do this. In other words, you shoot the shot, make your call and correct for it, quickly shoot again, call, and if it's drifted a bit right, you click, quickly shoot another, etc. You correct off each shot for windage, but you have to do it extremely fast. This method is a good way to shoot when it's calm, say after a rain, when you can't see mirage and the wind flags aren't doing anything. Hopefully you'll catch any change before it puts you out of the ten ring, but you must be fast. It's also an easy way to dump or shoot out several shots. There are times when it is an effective technique but I don't recommend it as the best way.

IW: I talked with Herb Hollister about this and he suggested you watch the wind flags about five minutes before it is your relay in order to know the dominant condition and secondary condition that you may want to shoot in. He suggested you use the dominant condition as your zero and work from there.

MM: Yes, this is probably the way most good shooters shoot. When I shot the Wildcat out here in 1970, we didn't have wind flags downrange. I understand now they have wind flags all over the range, which isn't exactly according to the American prone rules, but certainly you can watch them to help you shoot American when they are out there. After you set up your gear, while you're getting yourself settled down to shoot the match, you can be watching the wind downrange. This saves both time and sighters, and more importantly - points.

Okay, now to mirage. We're going to work with this at the range. The only way you can learn mirage is to get out there and watch it. When you finish your practice or you're resting before your next position, just lay there and look at the mirage. Experience is the only way to learn it. In general, the slower it goes, the deeper the waves are going to be. . When it is running faster, the waves flatten out like this . And the direction it goes is just like waves in water if you look carefully. It's really best to read it across the face of the bull's-eye, but this is harder to do. You can look at the edge of your target frame, or with the Gehman boxes, look at the green edge just below your target face or at the top of the box. It's best to read across the face of the bull because that's what you're shooting at, what you're shooting through and what affects your aiming point. The bull will look pretty clear on one side and sort of squiggly on the other side. If the mirage is running from left to right, then the right edge of the bull would look squiggly.

DK: When I'm having trouble being sure about the direction across the face of the bull here at Black Canyon, I look at the printed numbers on the target face and can usually tell for sure. On the NRA targets, I look at the "S" on each side of the sighter.

MM: I agree. Also, if you're shooting 100 yards on the American target, there is a big difference between what the mirage is doing on the top bull and on the bottom bull because they are so far apart. You need to keep your wits about you, but it's generally worth more down below. If you're centered on your first

100 yard bull, you may need to hold into the mirage a little on the bottom bull. At least that has helped me. It took me a long time to figure that out.

You need to look at wind and mirage as two separate entities - if they are working together, they add to each other. But on some ranges, you get a swirl and the wind and mirage do not do the same thing. On Black Canyon, the wind does not usually swirl, but often the mirage will change direction before your wind flags do, even the flag closest to your box. Just before you are ready to shoot, take a quick check in your scope to be sure the mirage has not changed direction on you. The wind flags will tell you wind velocity, but you can save a point by picking up on a mirage switch. Here it usually changes downrange first and works back. After a rain, or after they water the grass here, the mirage will usually be really heavy when the sun first appears due to the damp air.

RF: Is there some sort of rule to follow as to how many clicks to take from the sighter bull at 100 yards to the bottom bull?

MM: Not really. It's independent from one range to another and from one day to another. When you are zeroed on your sighter and you go to your first bull, you'll see it's worth a little more. So figure out what that correction was and double it for the bottom bull, but you just need to watch it on each range. When you are writing in your diary, be sure you put in the weather conditions for each range. If you shot out the top on a particular range, jot down that you did so, but couldn't figure it out. The next time you go to that range, you read the reminder about elevation and maybe this time you do figure out why and can write in the solution.

MA: Can you explain how to go to a new range and figure it out? Say you arrived just for the match, so you can't spend a day or two in practice.

MM: This is hard to do. You need a little practice time.

MA: I see this as a major problem for civilian shooters. MTU usually gets there early so they can practice, but often civilians can't.

MM: If you're shooting international and you have only ten sighters, use your sighters very carefully to see what it is doing. Be very aware of all the checks you can find to know what is going on out there on each shot. Look at anything that's moving in front of you. Also you can listen to the guy next to you. Some shooters will tell you the wind switched, not in those words, usually they are four-letter words. Ten sighters is a lot if you really use them wisely. A lot of Europeans don't. They want to shoot all tens on their sighters, and won't go for record unless the last shot was a ten. It just ruins them when we sight in with a couple of tens, then shoot several nines all over, call for our record bull and run tens. They just know we aren't zeroed. It only takes two shots at the most to be zeroed. The rest should be used to learn about the wind. You are just testing to see what you can play with, learning how far you can let it go before you are out.

MA: When you're shooting standard rifle, and you only have six sighters, that really brings it down. If I sight in on my primary condition, then I lose

patience waiting for the secondary condition to come because I feel like I'm wasting my good condition. What do you do?

MM: If it is really holding steady, you can go ahead and get your ten shots downrange. When you sight in, learn how much variance you have on your primary condition to play with.


MA: Would you talk about the use of six sighters. It might help the women and juniors.

MM: Well, some of what I said for air rifle applies here. You should adjust your position, hold and be sure you're ready before you put your first round in the rifle. This way when you take your first shot, be very sure you can make a good call on it. Shoot the first shot in the condition you want to shoot in, see where it goes and make a full correction. The first shot must absolutely be on call. Don't mickey mouse around taking a click here and a click there. If you have missed it, you might as well miss on the other side as on the same side again. Then you have four or five shots for wind. With standard rifle, I sometimes use all my sighters. When you have ten, you should save one for an emergency. You should practice sighting in this way, so you can learn what you need to know with only five sighters, especially the juniors and women, because you have to use standard rifle. When I was at the MTU, knowing I would have to shoot standard rifle, I always practiced with only six sighters, even when I worked on free rifle. It might cost you a point in an unimportant match, but prepare you for the important one when you really need to come through with your standard rifle.

DK: It can't have hurt you the way you shoot both rifles!

MM: Thank you. Okay, now I want to talk about how to take windage. You can take it on your sights by clicking, both windage and elevation. You can shade on your sight picture by holding off just a little on the bull or you can take it by offsetting your sight alignment (keeping your bull centered but aligning your front sight off center in the back sight), or you can cant. The slowest way to do it is to click, but if you have the time and the conditions are not changing a whole lot, it is probably the easiest. You have trained yourself for years to have good sight alignment with the bull in the center and to squeeze off your shot. If you shade or offset sight alignment, you have to readjust your thinking and keep this in mind so you don't automatically line things up again. Clicking is a good way. Then on top of the clicking, you can employ your shading and cant as conditions warrant, to make that last final adjustment. Someone was talking about being able to see the wind flags in their sights the other day. This is the best position on the range. When you draw a point so that the wind flags are running downrange and you can see them in your sights, it is advantageous. This means you can shade or offset sight alignment, or cant at the last second and have within one click of what you want for wind. You can do this just before you break the shot, without removing your hand from the trigger. It's really a good technique to have.

Canting outdoors, the most I am able to use is to the inside of the ten line, without really taking a drastic cant. When you cant, the track of your bullet

goes this way ( track of bullet). If I move my rifle from

straight up to here (| - straight \ - cant), that's about from the center to inside the ten ring, as far as moving the bullet. I probably only cant about five percent. It's not an extreme cant.

DK: In order to use these techniques you must practice them, so you know how much they move you. You must have control over them and complete confidence in your ability to use them.

MM: This is very true. The technique I use most often after clicking is offset of sight alignment. You can shoot an eight really easily this way, unless you have mastered the technique.

Talking about shading, I think it also goes along with the psychology of positive thinking. You've all experienced shooting along with a good score coming and you start thinking, "Don't shoot an eight, don't shoot an eight," and sure enough, you shoot an eight. Whatever you're thinking about, you're probably going to do. When I'm shooting prone and I want to shade inside the ten ring instead of consciously offsetting my sight alignment, I just start thinking, "I want to shoot it on the right side, the right side" and it goes there, even though my alignment looks to me as though it is dead center. If you shade enough to see it, you are usually on the ten line or outside of it. Dave, how do you get it to the ten line?

DK: I like your idea. Do you do that standing also?

MM: Yes.

MA: The reason is physiological as well as psychological. You have keyed the right side of your body, have put it in readiness to respond.

MM: Right, it comes from training. I think if you'll try it, you'll find it works. Now, I've given away my secret. I can see Dave taking notes!

DK: Yeah!

MM: Now I want to talk about bad weather. That goes along with psychology too. You've all shot with the MPU in bad weather. Everyone is running up and down the line talking about how horrible it is, they don't want to shoot, etc., etc. Well, MPU is saying the same thing, but they know that if people think it's that bad, they're going to shoot bad. Why do you think the Wig prays for wind at Perry! Make up your mind you can shoot well in bad weather. If you believe you can, you will. You can also pray for bad weather when you need to catch up.

You've experienced hot weather now. The idea, of course, is to keep as cool as possible. Some of the guys wet their t-shirt. I use cold packs. You need Gatorade or salt pills. You should exert yourself as little as possible off the line. Anything you can do to keep your body temperature down will help keep your pulse rate down.

Cold weather can be miserable, but there are a few techniques which will help you. One - you can read the snow. It's really a neat condition to shoot in, if

you're not freezing to death while you shoot. You can see everything the wind is doing all the way to your target. You can see every swirl. If it's raining, you can also watch the angle of rain. You can see it in your sights while you are shooting.

DK: When I'm shivering involuntarily, just before I'm ready to shoot the shot, I tense my whole body, then relax and shoot the shot. You have about ten seconds that way to fire before you start shaking again.

DZ: Concentration helps because you forget about being cold.

DK: This cost Wig in the '74 World Championships. He'd just set a world record standing, but was shaking so bad in kneeling he couldn't perform well. His hand warmer had gone out and he was really cold.

MM: I agree with Diana about concentration. You can be doing very well on record shots and then you come to a sighter and relax your concentration just enough that you start shaking, and you can't stop it then. What Dave said is then the key to being able to get off well-aimed shots after you once start shaking.

DK: It pays to be prepared. Margaret carries her cold weather gear wherever she goes.

MM: I always carry my ear muffs, gloves, turtleneck dickey, down pants and two hand warmers. Also rain gear.

IW: I was told once in cold weather to breath a little deeper than normal and about half as fast.

MM: I haven't heard of that but it might well be worth a try. The other problem is that even in cold weather, your trigger hand has to be out. None of the rifle shooters are able to shoot with a glove on that hand. In prone, I stick my hand in my coat, then lay on it awhile. In standing, you can put both hands in, and in kneeling I put my hand under my left knee. Dave, where do you put yours?

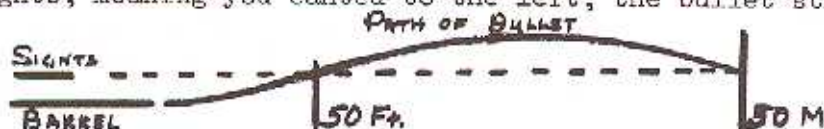
DK: I put my hand inside my sweat shirt at my neck. I always light two hand warmers. Then I wrap an extra sweat shirt so I can place my whole hand in with the warmer while I'm waiting for the target or conditions.

MM: One more thing on hand warmers. Being the intelligent group we are, when we get cold we get to thinking of better ways to keep warm. Some shooters tried putting their hand warmers inside their shooting jackets, which was great in helping to keep warm, but the fumes come up and we had one shooter pass out. Kendall keeled over in kneeling one day.

RF: I have a question about cant. Does the bullet go the direction you cant? It seems to me if you cant your sights left, the bullet should go right, but it doesn't. Why?

MM: Yes, the bullet does go in the direction of the cant. What makes the change in where the bullet hits is the relationship of the sights to the barrel and the effect of gravity on the bullet. This is a good question.

Mr. Rennie: At 50 feet your trajectory is coming up to the line of sight, hits it at about 50 feet, goes above it, drops back down to the point of aim. So this is the barrel, this is the direction of aim. You turn it like this and the whole works is turned over the sights. If your barrel is on the right side of your sights, meaning you canted to the left, the bullet strikes on the left.



MM: Right. This is a better explanation.

MS: On a day when it's cloudy and the sun is coming in and out, what affect does that have?

MM: If you shoot a post sight, this will be more of a problem because your bull looks blacker when the sun is covered so you actually hold lower which creates elevation problems. With an aperture, I don't think most people have elevation problems, but generally there is less mirage to read. As the sun disappears, you only have about thirty seconds, maybe a little more, before the mirage decreases. At least I can usually shoot one more shot. This is more important in 300 meters. Often there you can see the clouds changing a long way off so you can be more ready for it. When this happens you should immediately take a careful look through your spotting scope to see what direction and how heavy the mirage is running. Some days have light mirage, some days have heavy mirage.

MA: Maybe now you would like to ask questions about conditions on this range at Black Canyon. You know when this or that occurred but the result wasn't what you calculated.

DZ: I was shooting prone at 300 meters and everything that I could see was the same, but I lost one for elevation. How could I have prevented that?

MM: Okay, at 300 meters, the first thing I would look at is my back sight. If you just got zonked with the rear sight, it may have caused it to slide forward. Secondly, you have a tendency to move your head position more 300 meters on your stock which changes your sight alignment. Also, all errors are compounded 300 meters. You have an unconscious tendency to keep crawling up on your sights, until you get hit again and you remember you are shooting 300 meters and not smallbore.

IW: Writer mentioned this about Black Canyon and you also experienced it at Rio Salado. When the wind comes in from the back, it has a tendency to roll which gives elevation changes. How do you watch for it.

MM: I pick it up on my wind flags. It seems to occur here when you get a little wind on your face, a little breath of fresh air. It means something has changed. You will see your flags move in a different direction from which they have been blowing, more or less straight with small variations.

DK: Also, checking the dust on the berm is a good indicator of elevation at Black Canyon.

IW: If you are watching your near flag, and say it's toward the end of the time when no one is shooting near you, so you can't watch the dust, what is really important as an indicator here? How can you anticipate this type of change?

DK: Well, like Margaret says, I can feel or hear the air coming from behind me. Sometimes I can hear the trees behind. It does become kind of a sixth sense - the experience factor we've talked about. Sometimes if the air has been fresh and it suddenly feels muggy, that indicates a change.

MM: Sometimes the whole end of the range will stop shooting. This can mean they've all shot one out and are trying to figure out what to do next.

MA: I learned a long time ago, shooting beside the heavies at MPU, that if they stop, you stop.

IW: I've always had elevation problems on this range. For the first two years I thought it was me, but I finally figured out something is happening out here to cause it.

MM: I understand you have some serious eye problems that make this more difficult for you. But with you juniors who have good eyesight, you have to develop enough confidence in your equipment and ability to believe what happens on a new range. If you left home with your gun shooting good and your ammo shooting good, and both were transported carefully, and you know you can call a ten and shoot a ten prone, if the shot isn't a ten, look for range conditions as the cause. Be really honest with yourself. You all shoot well enough to know when you shoot one out. But don't always blame yourself either. If the shot wasn't a ten - look immediately at all the indicators you can find to see why it wasn't good.

ES: One of the conditions I shot in out here was one in which all the wind flags on both sides of me were pointing at the target.

MM: That's a bad situation. I had never shot in the middle of the range before, so I read a lot of stuff this year I've never read before. We also got more elevation than usual. In the middle, I found you couldn't get a strong condition to hold at all as things from both ends seemed to meet there. All I can tell you is to pick the set of flags closest to you and then read the direction the wind is coming from off those flags first. Shoot on the flag that gives you the direction as the wind comes in, because that's what your bullet is traveling in. What has already gone past doesn't concern you. When they are coming from both ways, you'll just have to wait until you can get them to do something. Look down-range both ways. You can see the two ends, which means you can watch the change coming in for quite ways. On most all ranges you can watch a change come across. This again is an additional indicator that beginners don't use, but as you become more experienced, you can watch more indicators in the same amount of time.

EH: I was shooting one day on the high end, about point ninety-six. The flags close to me were blowing just a little bit toward the end of the range, but the big range flag was blowing hard in toward the range. It is higher than the others, but I didn't know which to believe.

MM: Well, when you're shooting on the high end of the range here, believe the large wind flag. It's out in the open and is influenced very little by wind being blocked by the building. You'll find it usually changes direction before the small flags. The high end of the range is definitely the most difficult here.

MB: I've found shooting on the low end of this range, you need to watch the large range flag some, because the wind comes off that bank and down. The low wind flags don't indicate the change until too late sometimes.

MM: Yes, anytime you shoot on a range with a wall, or break of any kind like a berm or trees, if you can get the wall, get it. The guy that is hurting is about five to ten points out. The wind often runs down the bank and then circles, and you get elevation.

MA: How do you read a baffled range like those in Europe? One of these days the juniors will be on these ranges, never having been on one before.

MM: Well, Mexico is baffled, so let's talk about it. Pay attention to your wind flags. When the wind starts coming in from the front or back, it starts hitting the baffles and then comes down. In Mexico, because you have the building and then three sets of baffles, you'll experience low shots when it starts coming from the back and down off the baffles, pushing your bullet down without showing on your flags. Mexico has very few conditions that give you high shots.

MA: On an European range, when you know you are getting a swirl because of the baffles, can you explain what your flag looks like when you read this condition?

DK: The flag ties itself into a knot!

MM: Yes, they do. Usually your flag downrange, and the flag close to you, are not going the same direction. Also, watch the other rows of flags along the side and you can see the swirl.

DZ: This is what happened to me in Switzerland. I was shooting on point ninety-seven and I was shooting in a "tunnel" for standing, but then the wind picked up and the tunnel got smaller, like points ninety-eight to one hundred, so I was shooting on the condition that I had a 200 prone in, but my shots kneeling were going everywhere. I still don't know what I could have done about it. The only thing I can say is that the flags were showing opposite what the wind was doing.

MM: I watched you shoot the end of that when you were having trouble. Do you remember those trees to the right? Whenever those trees started moving, it started swirling. I just didn't shoot when they moved. I didn't know what they were doing, I just knew if I shot it wouldn't be a ten. We could see you struggling, you'd get a ten, then the trees would start and you'd be out again. Unfortunately, we couldn't communicate it to you. You can't coach in ISU matches. But the shooter can come back behind the line for coaching. Yet you can't constantly be running back and still keep your match together either. It's a problem.

DZ: I didn't notice the trees. I just watched my flags and they weren't helping.

MA: It may help the juniors to know that when you're on a U.S. team, you get together and discuss things like this about the range, because you're all trying to medal first for the U.S. team. Sometimes one person will have learned something no one else saw and by being honest, as Colonel Pullum says, you share this and increase the team chances.

MM: We knew Diana was going to have the shot out, but we couldn't help her at that point.

DZ: Colonel Pullum said it took him a little while to figure out what was going wrong. That's one of those things you learn the hard way.

MM: Dave and I saw that range on the training trip in July. We saw it without the buildings, but came to the conclusion that we would have unusual conditions because the range was perpendicular between two parallel mountain ridges, one higher than the other. We thought the wind would either come down the valley off the high end, or across from the low end. The trees were large trees, so when the wind moved them, a lot was going on. Like Marie said, MPU always tries to get to places early. If you can get on a range before you shoot a big match on it, it's invaluable. In the 1967 Pan Am Games, MPU was invited to shoot on the range that spring before the Games in July. To this day, I credit this with winning the gold medal there and setting the world kneeling record. I was able to figure out that the wind usually came from the southwest. This is a good condition for me to shoot in usually. I like a fishtail wind when I have wind flags, because it only means a click or two back and forth to stay in. I had wiped out on an English Match there that spring trying to shoot that condition. I shot my kneeling in a hard sidewind, so the knowledge payed off. The first year I shot Benito Juarez really helped me before the Confederation of Americas. This means I already knew what the conditions would do, so I could concentrate on my performance. Come shoot Black Canyon as often as you can, because this is the range you have to master to make U.S. teams. Don't be too discouraged when you go home each night and think of how bad you did, but use it to learn. We were talking just the other evening about the first time we shot this range in 1969. It was very windy, and the heavies struggled to shoot in the 1130's. Now we can shoot 1150's, because we've figured out the range.

IW: Do you record range conditions at every range you shoot?

MM: Absolutely. I was busy my first year at MPU because I'd never been anywhere but Kansas. I had my little book and the second year I shot better on all those ranges. Also, I learned a lot about wind in general.

Okay, that's about it. Remember, the first thing you do on a new range is figure out the wind-elevation relationship and go from there.

RF: What causes a two o'clock shot here?

MM: Probably the wind has turned around. It was probably coming from behind, then changed so it was coming from nine o'clock. It was probably coming in from seven first and then moved to come in more sideways instead of from the back. When this occurs, you don't get the down draft from nine that you got at seven and this lets the bullet drift up, plus the wind is then full value. Now if the velocity of

the wind increased when it changed to nine o'clock, the shot would then be out around three or four.

RF: What about hot rounds?

MM: Theoretically, a hot round should go higher. Also, if you've waited, your barrel is cooler. To this you can add a couple clicks for superstition, so generally I just take the round out if I have to wait.

DK: I keep my ammo in a cooler and take out what I need for each position only, because I've found it does make a difference in this heat.

MM: A hot round does make a real difference at 300 meters. In prone at 50 meters where I usually shoot fast, when I'm waiting in-between shots, I take it out. In standing, where all the rounds stay in the chamber longer and reach maximum temperature for each shot, I don't take out as many. You don't shoot standing at such an even cadence as your prone.

Some of you look confused. A hot round means one that stays in the chamber of your rifle, after you've already fired several shots, when the barrel is warm. The bullet will warm up - that is become a hot round, while you wait for your condition. Your barrel also gets really hot when it's in the sun, like when you start prone on the left side of the booth out here. You know how hot your hand gets. When the round cooks, the powder gets hot, which means the round will have more velocity when it goes off, but you can't calculate how much affect it will have. It seems to be more critical in the heat here in Phoenix.

MA: What about shooting in cold temperatures?

MM: I don't worry about it. We don't have the accuracy problems at Benning and Benning can be really cool.

RF: Does the hot round theory apply indoors?

MM: No, not really. When you see me take a round out gallery, it's usually because I can't get the shot off. I take the round out, snap the trigger - my finger feels better, my head feels better and I load another round before going up again. Things are generally less critical at 50 feet. You can have a pretty bad gun and still shoot fairly well at 50 feet. It's just not that far.

I never worried about hot rounds smallbore until we started coming out here to Arizona. We never worried about it at Benning. It's just these extreme conditions here that made us all change our thinking a little about this problem. It is a valid problem for high power shooters, especially on American ranges without covers. Their guns sometimes get hot enough to send off a round.

Another way to keep your fingers warm in cold weather is to hold your brass when shooting 300 meters or hold your barrel.

DK: At Perry I never leave my block open with my ammunition exposed. I keep it in the shade of my position while shooting.

MM: That's a really good habit to get into. Don't pull a Wigger though. One year coming out here he had his ammo in his ice chest. Something went wrong and his ammo ended up in the water. He wiped out his best lot.

One parting remark. Don't let yourself be too upset by the wind. A good performance is far better than missing the wind occasionally. It's better to miss the wind than to shoot eights. If you have a good center hold you can miss the wind by four clicks, two clicks out either side before you have a nine.

MA: I know I've learned a lot by this discussion and I hope you have also. Weather is a major problem for collegiates who shoot mainly gallery, so hopefully Margie has really helped you know how to begin to amass the experience needed to be good at 50 meter shooting.

Students had just fired prone prior to this discussion, working on conditions and techniques such as shading and canting for controlling conditions.

MM: When you practice you should try to improve your performance, not just your score. You're trying to find out if what you're doing is working. It's working if your shots are going on call. A lot of people disagree with this, but there's not a world-class shooter that will disagree with what I've said. One of the reasons we had such a good team when Colonel Pullum was coaching us, is that he never pressed us for scores. You'll get on a team someday and you'll have some freeloader as coach who will want you to shoot your match score the day before the match to pick the team. What he should be asking is how was your performance today, were you satisfied, are you ready for the match? To do this you have to have a relationship of respect and honesty between the coach and shooter, and very few coaches are able to develop this. I know most of your college coaches are the "win, win" guys who know nothing about shooting, which is a major problem in the U.S. If you shoot low the day before a match, you will seldom do it on match day. You usually won't have to worry about the guy that shoots higher than usual the day before the match. He'll spend the match thinking about yesterday's score instead of his performance.

Okay, now we'll take pictures of your kneeling. Then we'll put you in a good kneeling if you want to change or are having some fundamental problems, take more pictures and send them to you so you can look at them once you're home. Hopefully you will be able to get back into what we put you in. Feel free to shoot awhile and relax awhile - don't stay in position the whole time.

MA: When you get home, some of your schools will have video tape machines. Maybe they would film you as they are doing another sport - say the gymnasts. The school might let a responsible rifle club adult instructor use the machine to film your rifle club in practice, if approached properly.

MM: Something I want to mention, a lot of you are putting your boxes and cartons of ammo on the ground. You need to take better care of your ammo than this. All you need is one grain of sand on one round of ammo down your good barrel and you've just ruined it. It's probably wise to keep your ammo in a sack of some kind - a canvas shot sack if you can get one from one of the shotgunners who reloads, or make one, but don't carry your cartons loose and don't put your ammo with the rest of your gear in storage or in transit. You must be aware of the temperature of the ammo, so keep it with you. Extremes at both ends - hot and cold - should be avoided, but especially heat. On trips I have even carried ammo into restaurants with me, covered of course, so as not to ruin a super lot by leaving it in a hot, locked car. Travel in pressurized baggage holds on airplanes is okay. We used to carry it on board but now, of course, you can't do that. Don't carry ammo in the trunk of a car, put it up front with you.

MB: What does water do to ammo? At Perry your ammo can get wet.

MM: It will shoot all over. When water reaches the powder, the accuracy is gone. Keep your ammo under plastic at Perry.

MM: To sum up - experience is the best teacher for reading conditions, if you put some real thought into what you are doing. Use your diary well and you will see an improvement in performance and confidence.