# Make Your Own Parabolic Reflector Windscreen

**By Randolph Scott Little**

Wind noise is a nearly perpetual factor in natural sound recording. The recordist's challenge is to minimize the magnitude of such noise relative to the desired signal being recorded. Technique, as alumni of the MLNS Natural Sound Recording Course know, is of paramount importance. Choose a direction and location so as to avoid most background wind-induced noise by minimizing noisy vegetation in line with the desired signal, situating the microphone in a lee and aiming into the remaining wind. Of course the microphone itself should be equipped with its own windscreen at all times while recording in the field.

Parabolic reflectors, aimed into the wind, create a small lee for the microphone. That is good, but you can do even better by adding a windscreen over the entire reflector. The value of this additional windscreen becomes significantly greater whenever the wind direction is not precisely on the axis of the reflector and whenever slight fluctuations in wind direction occur, which is practically always. Unlike microphone windscreens, which are commercially available accessories, windscreens for parabolic reflectors are generally not available. One exception is the Telinga Windcoat which is made for the Telinga Pro 21-inch reflectors. However, making one's own parabolic reflector windscreen is reasonably easy and wonderfully effective. This article describes how to do just that, using my 36-inch reflector with 12-inch focal length as an example.

**The Principle of a Windscreen**

The principle of a windscreen is to obstruct gross movement of air without significantly impeding the transmission of sonic pressure waves through the barrier. You are probably already familiar with two common approaches to this problem. Perhaps the simplest method is to embed the microphone in a volume of suitable expanded urethane foam, which is certainly practical and inexpensive and which will suffice for mild wind conditions.

However, as the thickness of the foam increases much beyond about one inch, transmission of the desired sound pressure waves becomes excessively impaired; so some other approach must be found for stronger wind conditions. A three-dimensional variation of the old studio "pop filter" is commonly used. The pop filter is a device placed between a vocalist and the microphone to prevent bursts of breath, created when uttering plosives (p- and t-sounds, for example) and fricatives (f-sounds, for example), from striking the microphone and causing an unnatural "pop" sound. This device consists of a swatch of fabric resembling that of nylon stockings, this swatch being stretched tight by a surrounding frame which is used to hold it as a screen in front of the vocalist's mouth. The idea, obviously, is to allow sound to pass virtually unimpeded while blocking or deflecting any plosive air-stream. It works very well for the intended purpose, though its two-dimensional form renders it much less useful as a general windscreen. The "blimp" windscreens for shotgun microphones are an excellent example of three-dimensional application of the pop filter principle. The blimp structure supports a taut fabric mesh that allows sound to pass freely while maintaining still air in the space surrounding the microphone. This same principle can be applied to the parabolic reflector.

**A Parabolic Reflector Windscreen**

As a long-time user of a 36-inch diameter aluminum parabolic reflector with 12-inch focal distance, I will report on my experimental design, construction, and use of windscreens for that reflector. While the measurements will necessarily differ for reflectors of other dimensions, readers should be able to adapt my design technique to suit the dimensions of their particular reflector.

The basic idea is to start with a large circular piece of suitable material, remove a section like a slice of pie, stitch the remaining material back together to form a cone, and sew an elastic cord around the base of the cone so that it will just stretch over the rim of the reflector. Two key dimensions, the radius of the circle and the angle of the pie-slice, can readily be determined by direct measurement on your parabolic reflector with your microphone in its working position. Those key dimensions can also be calculated; readers uninterested in the mathematical details may wish to skim rapidly past the next section.

**Mathematical Design**

The surface of a parabolic reflector is the set of points satisfying the mathematical relation:

$$y^2 + z^2 = 4kx$$

where the coordinate system is such that the x-axis is the "line of sight" of the system, the origin point (0,0,0) is at the very base of the reflector, and the focus is at the point (x,y,z) = (k,0,0), *i.e.* the focal length is k. Since this paraboloid of revolution has radial symmetry around the x-axis, we can also express the surface as the set of points satisfying the formula:

$$r^2 = 4kx$$

where r is radial distance from the x-axis. We will use this latter formula to deduce some further facts of our reflector's geometry which will be helpful in designing the windscreen.

The windscreen will be in the shape of a right circular cone, the base being the rim of the reflector and the apex being the outermost end of the microphone. We know that base diameter will be 36 inches, but how high will this cone have to be? The microphone, a Sennheiser MKH404 cardioid pattern condenser microphone, is mounted facing into the reflector with its diaphragm at the focal point, *i.e.* at x = 12 inches. Where is this in relation to the plane of the reflector's rim? Here is where we put the parabolic formula to work.

Given a k-value of 12 and plugging in an r-value of 18 allows us to solve for the depth of this reflector which we will call X. Accordingly, $X = 18^2 \div (4 \bullet 12) = 6.75$ inches. In other words the focal point lies 5.25 inches beyond the plane of the rim of this reflector.

As an aside, we call this a "shallow" reflector because its focal point lies considerably beyond its rim; as opposed to a "deep" reflector such as the Sony PBR-330 which has a 13-inch diameter and about a 3-inch focal length. An inward-pointing cardioid microphone is appropriate for a shallow dish; whereas, an omni-directional microphone is appropriate for a deep dish.

Returning to the design of our windscreen, we want the apex of the cone to be at the rear of the microphone, so as to enclose the entire microphone within the lee of the fabric. Actually, the rear of the microphone's cable connector is where the apex should be. This is 5.5 inches from the diaphragm, so the total height of the cone will be 5.25 + 5.5 = 10.75 inches.
With base radius of 18 inches and cone height of 10.75 inches, the slant height, *i.e.* the distance from the rim to the apex can be calculated by the Pythagorean theorem as:
$(18^2 + 10.75^2)^{0.5} = 21$ inches.
Remember this key dimension, the radius, while we determine the angle of the pie-section to be removed.
We know that the base of the conical windscreen must coincide with the rim of the parabolic reflector; therefore, the radius of the base of the cone must be 18 inches. The angle of the section to be removed is simply:

$$360° \cdot (21 - 18) / 21 = 51.4°$$

Conceptually, we will take a 21-inch radius (42-inch diameter) circle of fabric, make two radial cuts that are 51.4° apart to remove a pie-like section, and sew the remaining edges back together to make a cone. Practically, however, we must increase the diameter of the circle by 3 inches (now 45-inch diameter) so the windscreen can be stretched beyond and around the rim, and we must remember to leave enough of one edge of the pie-like slice so we can make a decent seam.

**Pattern Making**

Now, although we have calculated the key dimensions, we recommend making a pattern out of heavy paper, then fitting the pattern to the reflector as a final check before actually cutting any fabric.
Assuming that you don't happen to have any 45-inch wide construction paper, cut several grocery shopping bags apart, lay them out flat, and tape them together so that you can cut a 45-inch circle from the assemblage. Then cut a single radial line from the rim to the center of the circle. Notice that by overlapping the two cut edges the flat circle becomes a rising cone. Place it over your reflector (with microphone in place) and overlap the two cut edges until the cone fits snugly along the rim of the reflector. Mark this amount of overlap by drawing a radial line, defining the conceptual pie-like section mentioned above. Now draw another line parallel to the first but about one inch into the pie-like section. After the remainder of the pie-like section is removed, this inch-wide strip will provide enough overlap to sew a good seam for forming the desired conical shape. Note also to leave a small hole at the very center for passage of the microphone cable and connector; a small ring of scrap fabric can be sewn around this hole for reinforcement.

**Materials**

Two important characteristics of any fabric selected for windscreen material are "stitchability" and dimensional stability. By stitchability I mean it must be possible to sew a seam in the material and have that seam hold firmly under moderate tension. By dimensional stability I mean the fabric must not stretch appreciably under tension. I would add a third characteristic, more important than the other two, that the fabric should be acoustically constant at all frequencies of interest; but the acoustic properties of fabrics are not generally available.
Speaker grill cloth generally exhibits the first two characteristics, and could

Figure 1. Rear View of "Black" Windscreen System

Figure 2. Front View of "Black" Windscreen

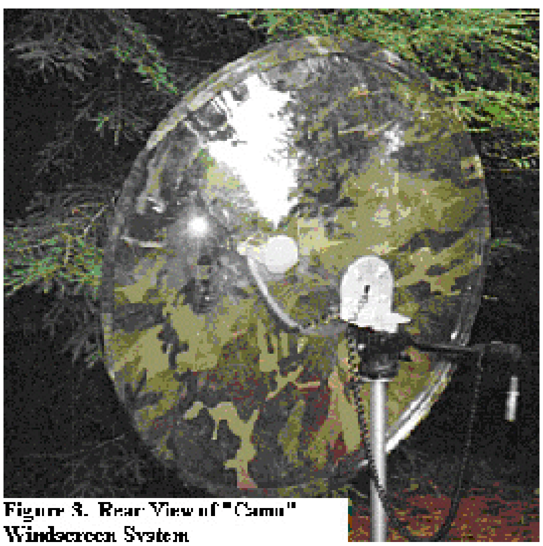

Figure 3. Rear View of "Camo" Windscreen System

Figure 4. Front View of "Camo" Windscreen

reasonably be expected to be superior to other fabrics in that important third characteristic. I constructed one windscreen (see Figures 1 and 2) of black speaker grill cloth. One source of acoustic speaker grille cloth is Wendell Fabrics Corporation, Post Office Box 128, Blacksburgh, South Carolina 29702, Telephone (864)839-6341, Fax (864)839-2911. They offer a line of high quality acoustically transparent grille cloth under the trademark name of Mellotone. Their website: http://www.wendellfabrics.com/grille.html offers examples of the different types of available fabrics, some of which have

elastic characteristics. Prices for Mellotone® acoustic range from $10.50 - $22.50 per square yard with a 5 yard minimum purchase. Another source of grille cloth is Meniscus Audio Group:
4669 S. Division Ave.
Grand Rapids, Michigan 49548
616-534-9121
Their website:
<www.meniscusaudio.com/accessories.html>
They provide 60 inch- wide stretchable cloth in five colors, including black and brown, for $2.25 per foot.
Mosquito netting or camouflage netting of similar texture also come to mind as potentially useful materials for this purpose, perhaps offering a better visual blend into natural surroundings than speaker grill cloth. I constructed a second windscreen (see Figures 3 and 4) of "Standard Mesh Woodlands Netting" obtained from Cabela's, One Cabela Drive, Sidney, Nebraska 69160. Cabela's Fall 2000 Master Catalog lists this material as "Heavy-Duty Camouflage Mesh -- Advantage, Timber Mesh ". Other patterns, "Realtree X-tra Brown, and Realtree Hardwoods" are also available. Note that some camouflage cloth materials have a more open weave than others. Be sure to ask for camouflage netting, its weave fine enough to exclude insects. In addition to ordinary sewing thread for the seams, you will also want several yards of round elastic cord, such as Stretchrite® 3960 made by Rhode Island Textile Company, Pawtucket, Rhode Island 02862, to serve in lieu of a drawstring.

**Assembly**

After cutting the 45-inch circles of material and removing the pie section, roll the outermost inch of material over on itself and use regular black sewing thread to form a pocket through which later to string the elastic cord.
Next, hold the partially completed windscreen in place over the parabolic reflector and check the proper placement of the radial seam to ensure a tight, tent-like fit. Start the seam far enough from the center to leave room for the microphone connector to be fed through the center opening, and stop the seam just short of the pocket which was previously sewn around the outer edge. Now sew that seam and double-check for a tight fit over the reflector, re-sewing if necessary to get it right.
The elastic cord can now be strung through the circumferencial pocket. Tie the ends of the elastic cord together so that, when the windscreen is stretched over and behind the rim of the reflector, it is held tautly in place.
Finally, cut a washer-like ring of scrap windscreen material and sew it around the central hole for the microphone cable as a precautionary reinforcement.

**Usage Notes**

After several seasons of use, I have been quite pleased with both windscreens, with no second thoughts about the design or the materials. Although I would still like to make controlled measurements to determine the signal and wind attenuation as a function of frequency, subjectively I can report negligible signal attenuation and significant wind attenuation. These advantages are so noticeable that I now routinely use the "camo" windscreen even in calm air, where it offers the additional advantages of keeping pesky flying insects away from the microphone and helping to blend the recording outfit into the environment.

The speaker grill cloth windscreen offers considerable additional wind attenuation. Whereas on a windy day I would seek a better venue, now I put on the “black” windscreen and get on with the recording. In fact, “camo” over “black” is a great combination for otherwise impossible situations.

So, for all of you parabolic reflector users, I highly recommend tailoring your own windscreen and extending your good recording opportunities.

**Acknowledgments**

Thanks and acknowledgment to my wife, JoAnn, for suffering my foolish notion that cheesecloth would be a suitable material (it isn’t; don’t even think about using cheesecloth) and rounding up the proper materials, to Greg Budney for suggesting sources for said proper materials and to Greg Clark for developing the clear plastic reflector used in the illustrations.

*About the author:*

*Randy Little has been one of the mainstay instructors at 14 sound recording workshops, starting with his first in 1987. His favorite recording is one of a Hermit Thrush from the Adirondack Mountains in Upstate New York. This recording was included on an LP disc as one of “The World’s Most Beautiful Bird Songs”.*