Wing Tip vs More Common Types of VOR Antennas
By Bob Archer of Sportcraft Antennas

What? Are you crazy? Everyone knows that wing tip antennas have never, will never and Cannot ever be made to work!!!

Who Said That?

I will attempt to here to discuss all the various types of VOR antennas and how they compare to the Bob Archer wing tip VOR antennas.

In the last few years I have noticed that most all of the newer rabbit ear Vor antennas are using Ferrite transformer baluns. These are pretty neat little devices, they are small and make a nice little package and make the antenna Impedance look very good, BUT they have a loss of at least 2dB of signal, which is about 25% that is being wasted. I looked into using these baluns when I designed my dipoles but decided I didn't want to waste perfectly good signal. Rabbit ear antennas are undoubtedly the most common type of Vor antennas and are normally installed on the top or near the top of the aircraft vertical stabilizer. These are really dipole antennas, the radiating elements of which are either swept backward or forward but not normally installed directly opposed to each other. If installed directly opposed would have wide and deep nulls in the radiation pattern which would have no or very little signal off to the sides of the aircraft. By sweeping the elements the holes are filled in a little so some signal can be received from the sides. The radiation pattern of dipole antennas is a figure eight with the two circles, one fore and one aft of the aircraft. These two element dipole antennas do require a balun to work properly. In addition each of those rabbit ear elements cost about one horsepower to drag through the air at 150MPH. I have a drawing that I give away to anyone wanting to build a balun of his own.

Towel Bar and Blade type of Vor antennas are pretty much the same in that they are very small for the wavelengths involved. Being small the basic impedance is high and extreme measures must be taken to match the impedance back to fifty ohms and efficiency is degraded in doing so. I saw one brand that actually fed the two sides with about eight feet of small coax to mask the actual impedance. The two sides of these types of antennas must be fed 180 degrees out of phase to give the proper radiation pattern. The one

very good thing about these types of antennas is that they do have a good omni directional pattern. Of course the towel bars are dead ugly and they probably have about the same drag as the rabbit ears. At least the blades are low drag and they don't look so bad.

Another fairly common type is the flying wing on a mast type. The Beechcraft model has a Com antenna with a Vor antenna on top. I tested one of these several years ago and found that the Com antenna was pretty good but the Vor was completely off scale bad at the low end of the band. This type of antenna is known as a dipole over a ground plane and has a radiation pattern that has most energy straight up if installed on the top of a fuselage. Some energy will be on the horizon but not very much. V tail Bonanzas used these because they don't have a tail to mount the rabbit ears on. The early Bonanzas used rabbit ears installed under the V tail and again the radiation pattern is mainly straight down. I had a friend with one of these and he had a maximum Vor range of about 30 miles.

Wing tip antennas historically have never worked. People have tried and failed miserably over the years. Bob Archer wing tip Vor antennas are different than any of those types. They are monopole type antennas that use a Gamma match type of feed so that they can be grounded and have enough variables in the design so that the antennas can be impedance matched across the VOR and Localizer band of frequencies. The grounding of the antennas helps reduce any possible noise problems and solves the problem of the nav light wires interfering with signal reception. The radiation pattern in the horizontal plane is kind of non-symmetrical, unlike the dipole antennas installed on the aircraft centerline. But they are very efficient and in normal use the lack of symmetry will not be noticed. They can be used to receive the glide slope frequencies with the use of a frequency splitter box though some of the newer radios have the glide slope couplers built in.

I have had reports from high flying pressurized Lancair IV flyers that they have reception of 200 miles or better. Many builders of various types of aircraft report at least 100 miles at moderate altitudes.

If you have any questions let me know at bobsantennas@earthlink.net