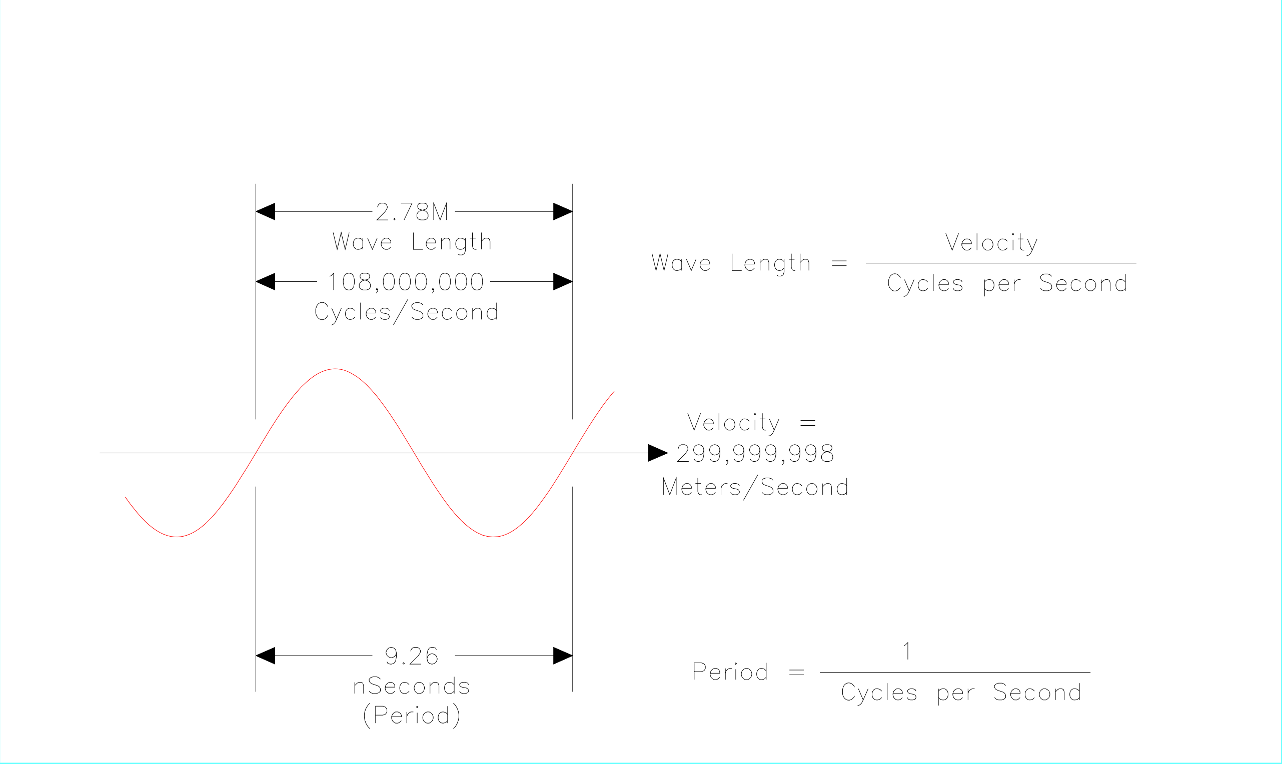
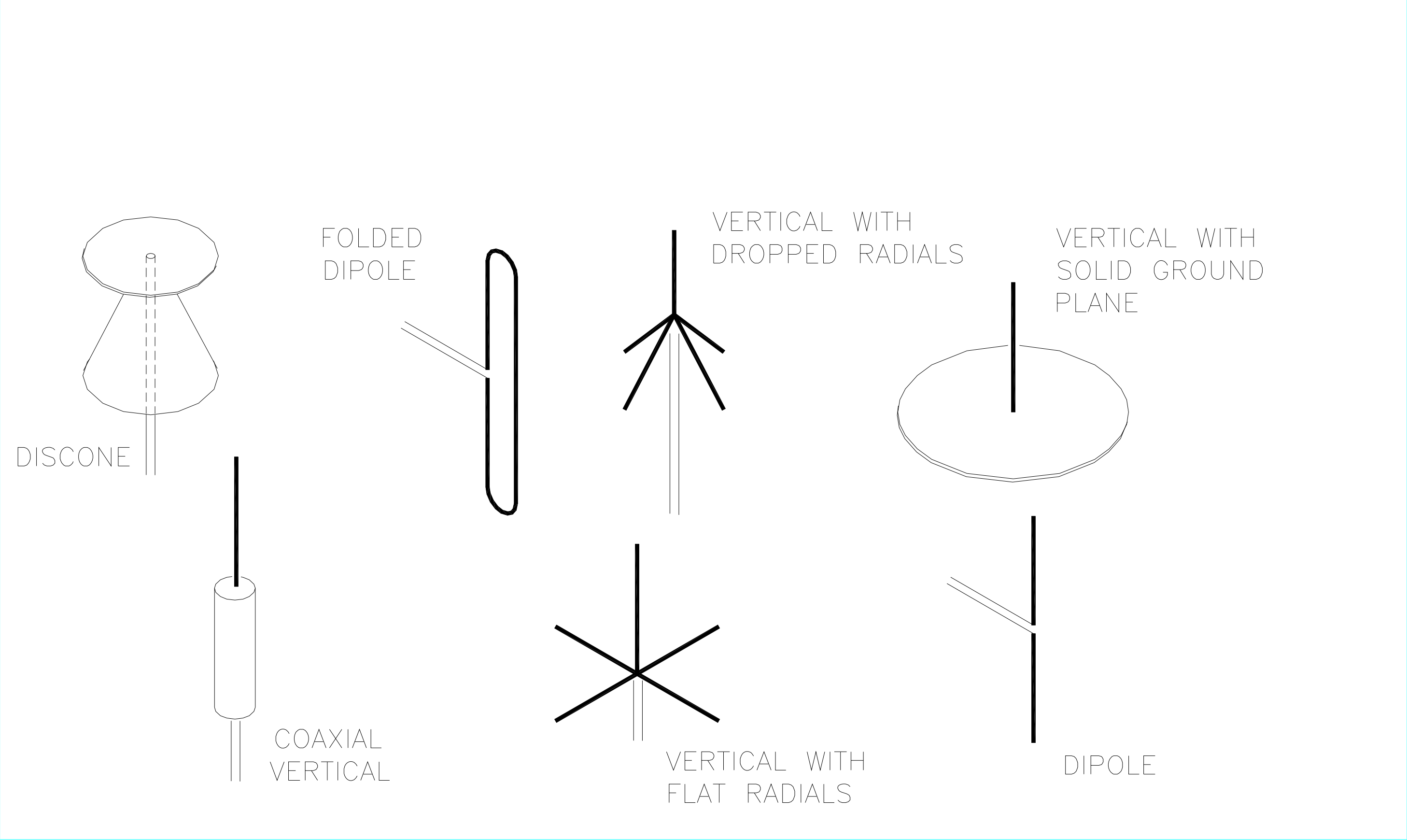
Antennas and Feedlines

- **The critical size of an antenna is a function of its operating frequency**
- **The higher the operating frequency, the smaller the antenna.**
- **Exact lengths are related to electromagnetic wavelengths in free space at the operating frequency.**



Antennas come in a lot of flavors but fall generally into two categories:

- **1/4 wave antennas that work against a GROUND PLANE and . . .**
- **1/2 wave antennas that do not need a ground plane.**



A COMM antenna centered on 108-135 MHz band would have a 1/4 wavelength of:

(300/127Mhz) x 39.4 In/M x .25 Wavelength = 23.2”

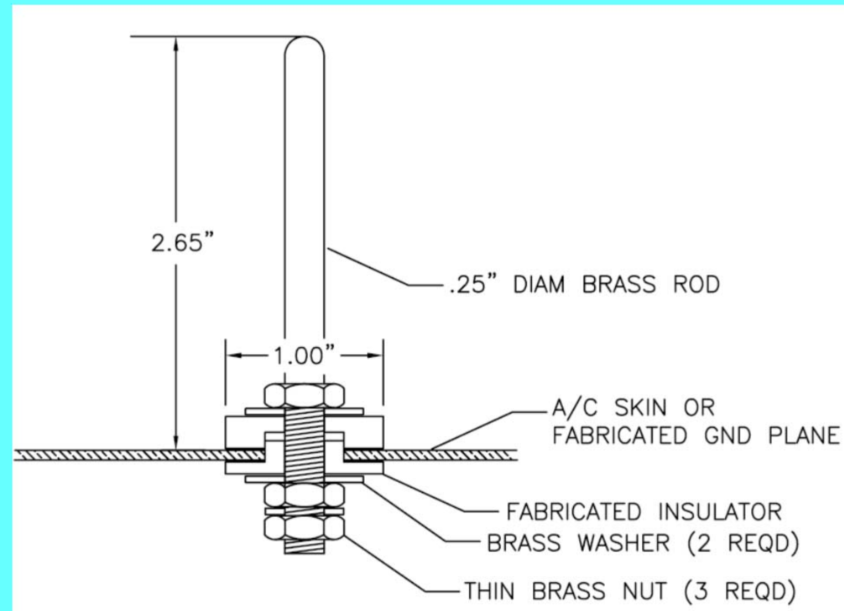
BOTH of these antennas are installed on the A/C for vertical polarization . . .

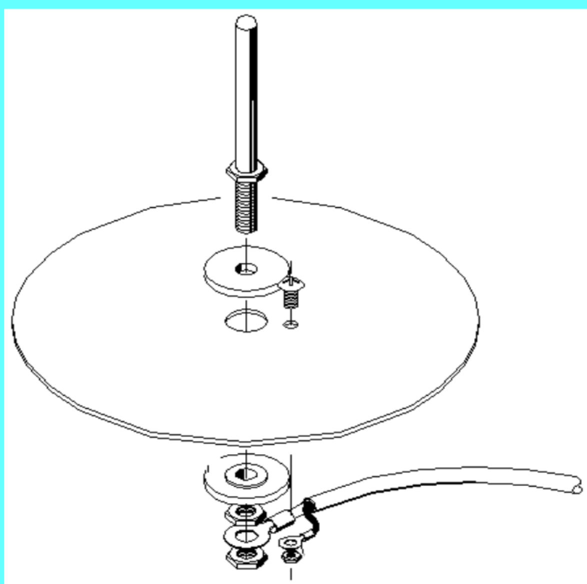
A Transponder antenna centered on 1040 MHz would have a 1/4 wavelength of:

(300/1040Mhz) x 39.4 In/M x .25 Wavelength = 2.8”

Transponder and Comm antennas are 1/4 wave, vertically polarized conductors.

They're not difficult to build but testing the performance of one's handiwork . . .

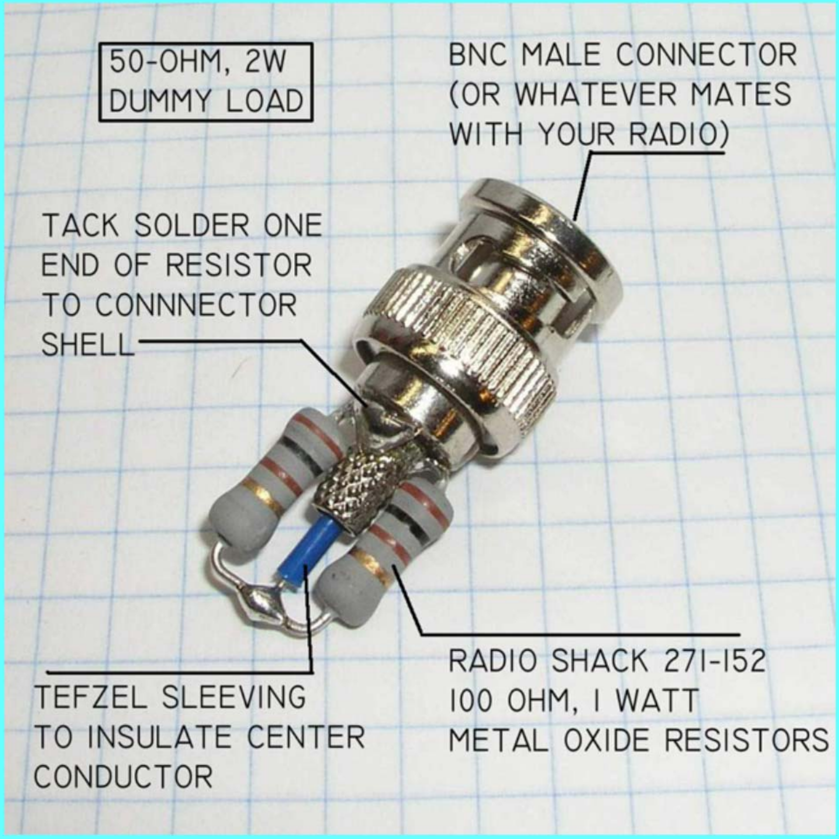




. . . is generally beyond the toolbox of the average builder.

Purchased antennas are pretty reasonable and a better return on investment for $time$ expended to acquire them

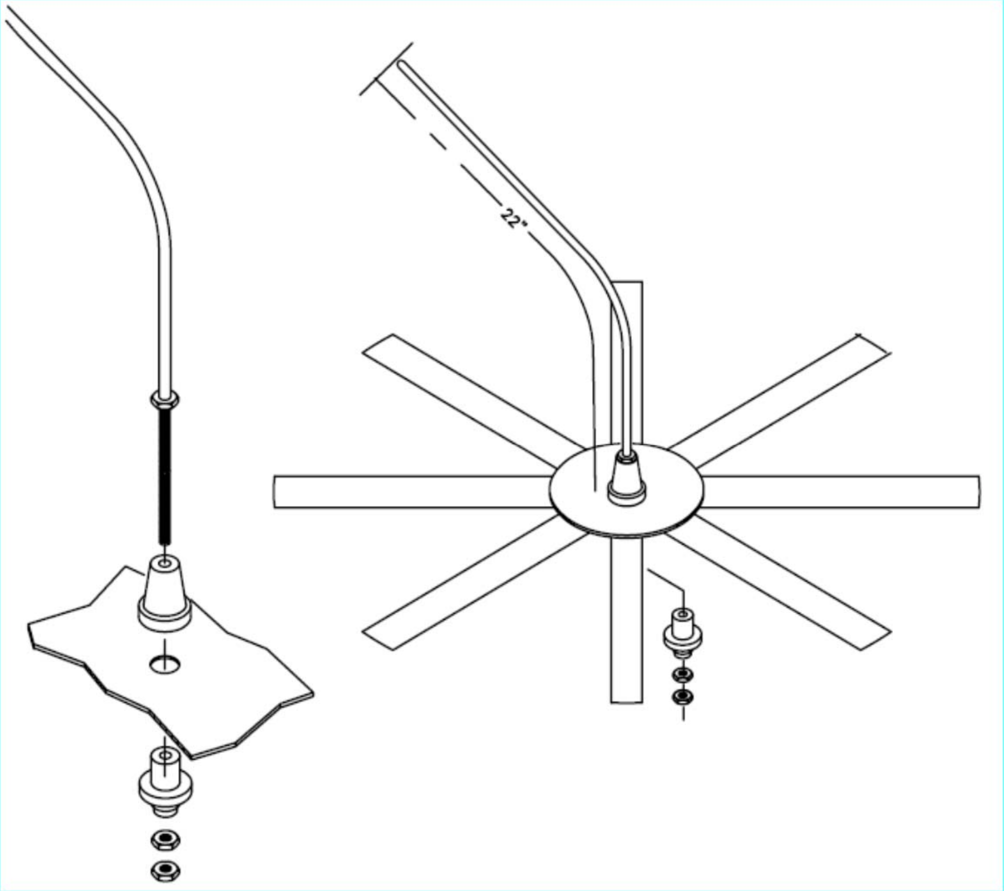
- Testing an antenna for Standing Wave Ratio requires the use of an antenna analyzer. Here's a device that sells for about $350 which is useful over the range of 2 to170 Mhz.
- I'm aware of no "low cost" devices for antennas in the transponder/gps frequency ranges.



- **Testing the SWR of an antenna speaks only to the antenna's ability to accept power from the transmitter as delivered by the transmission line.**
- **It does NOT speak to the antenna's ability to efficiently radiate that energy.**
- **This piece of test equipment is called a "Dummy Load". It's a couple of resistors arranged on a coax connector to emulate an ideal antenna but have nearly zero radiation efficiency. All energy fed to this device is tossed off as heat.**
- **A dummy load is useful for testing a suspect coax cable or investigating certain kinds of radio frequency interference problems aboard the aircraft.**
- **You can build one from Radio Shack parts in a few minutes.**

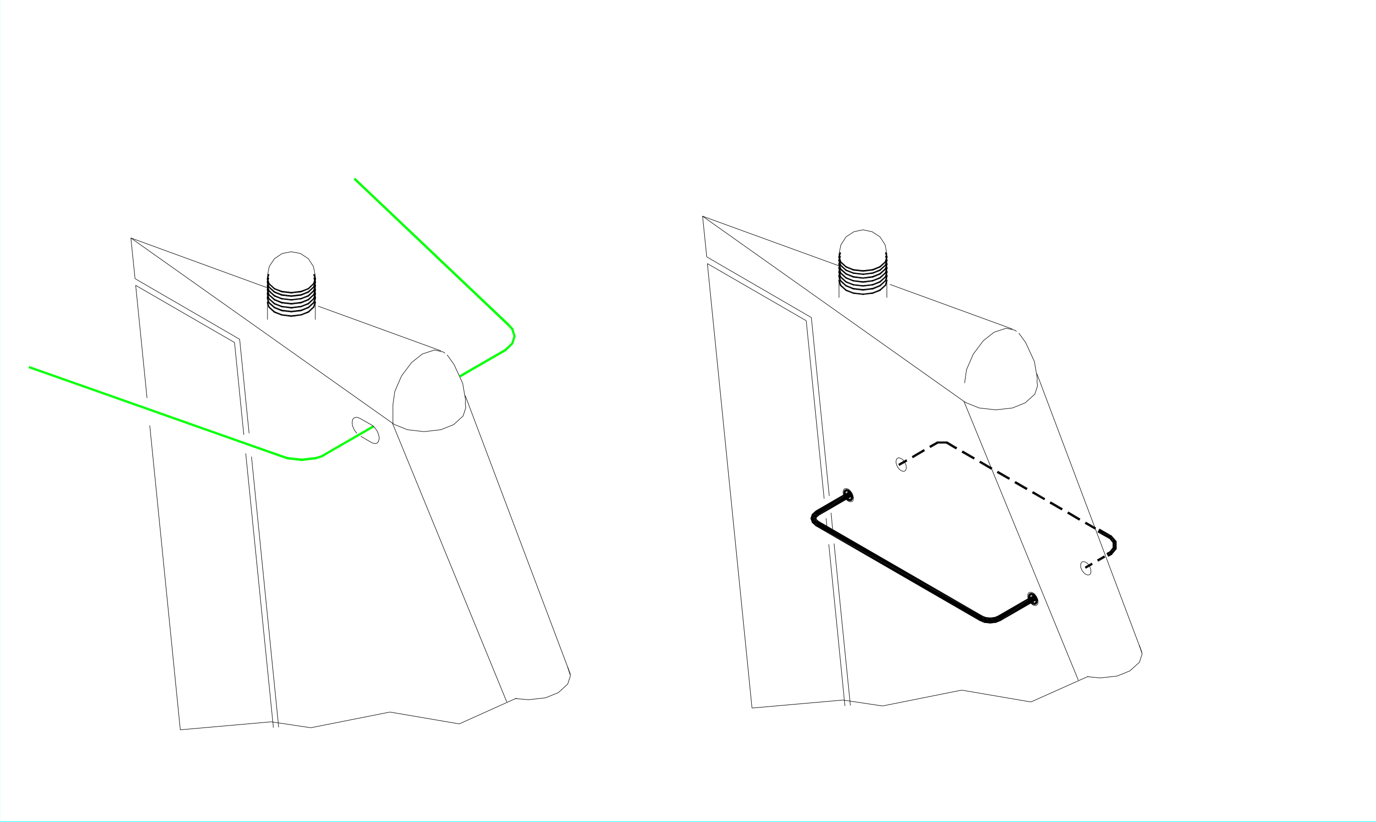
1/4 Wave antennas need a ground plane for proper operation. If the airplane's skin is a poor conductor then an artificial ground plane must be constructed at the base of the antenna.

In the case of the small transponder antenna, the ground plane can be a solid disk of aluminum or brass. For COMM antennas, an array of 1/4-wave "radials" fabricated from copper or brass strips soldered to the commoning disk at the base is a fair approximation of the solid disk.



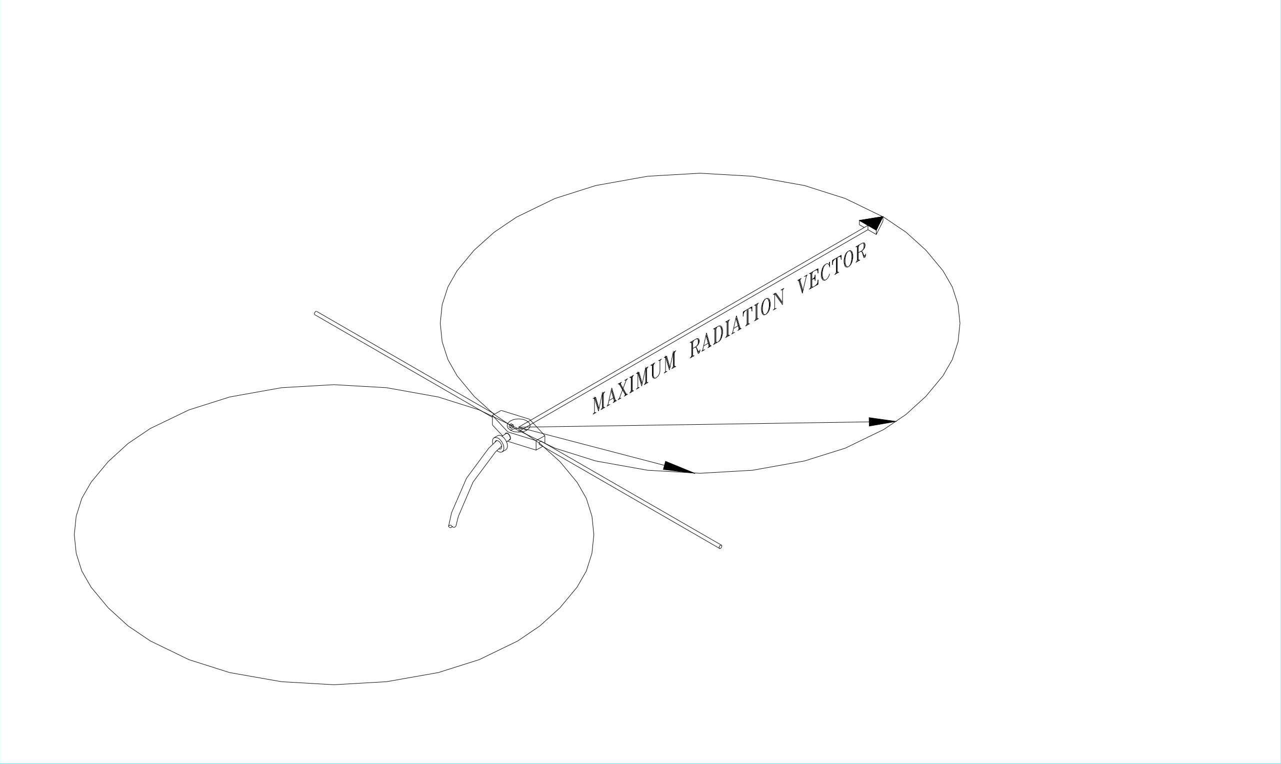
VOR Antennas are HORIZONTALLY polarized.

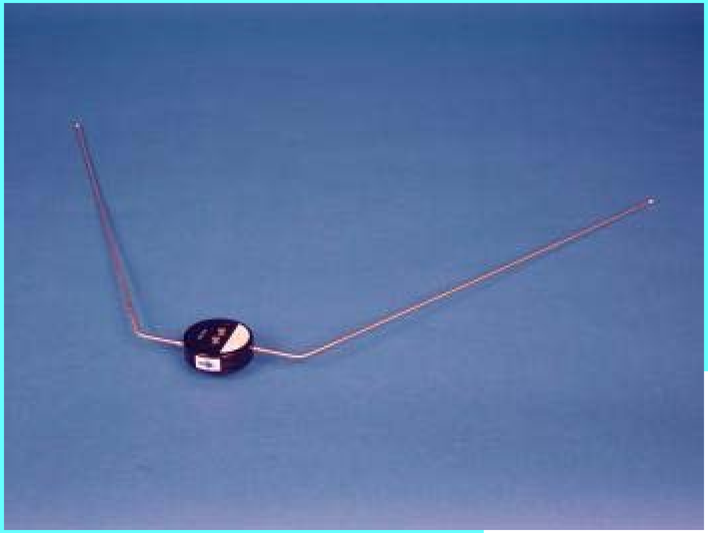
Most popular location for high performance VOR antenna is on the vertical fin.



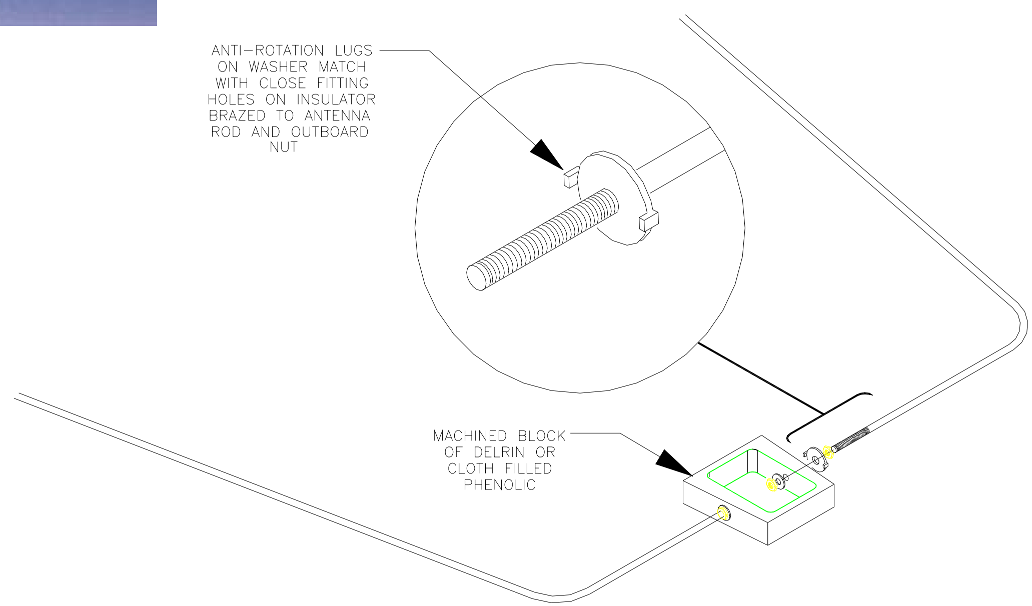
Antennas have radiation patterns and polarization patterns.

Here we illustrate the broadside patter of the dipole and in this case, the dipole is horizontally polarized.



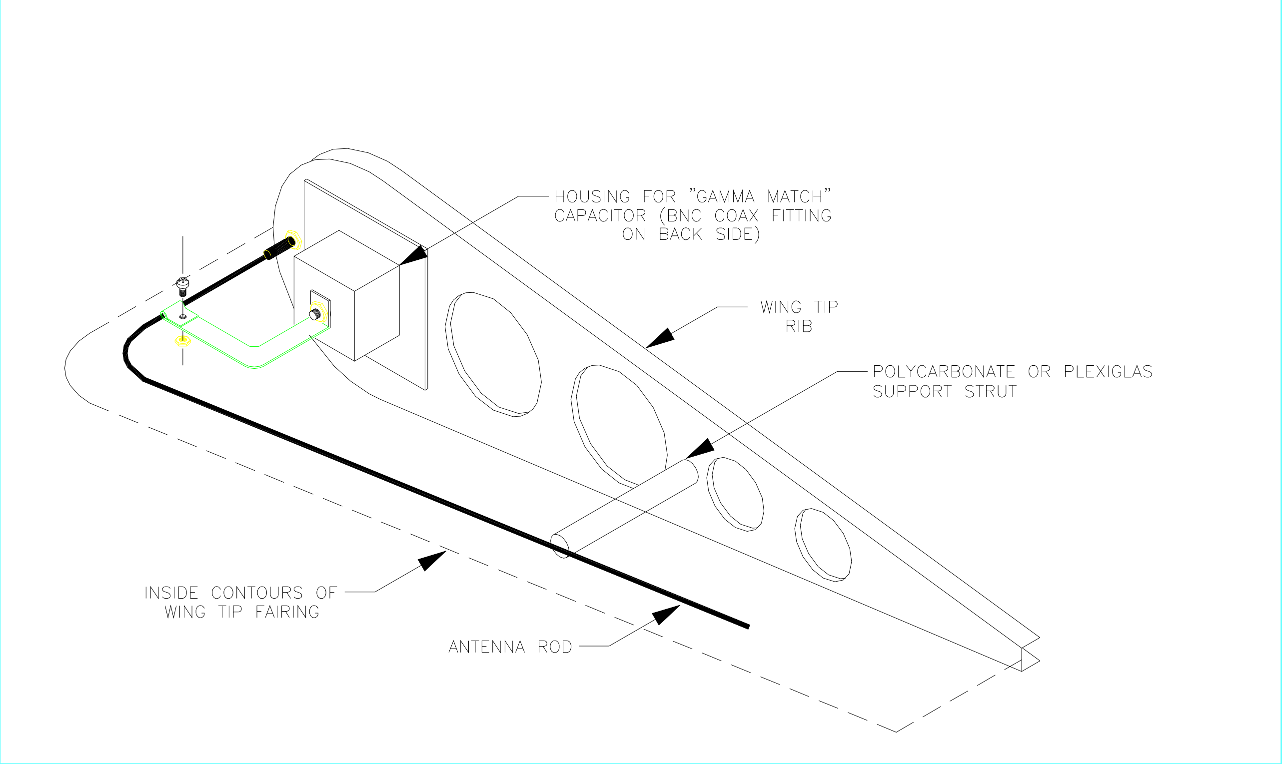


The popular "cat whiskers" VOR antenna found on the vertical fins of most light aircraft is a modified, horizontally polarized, half-wave dipole.

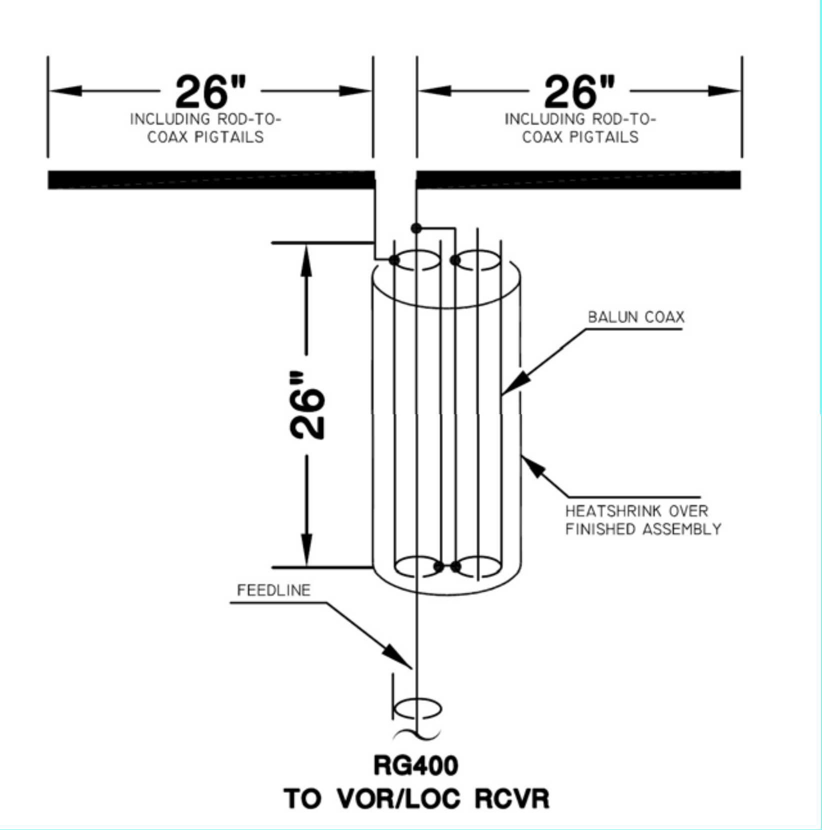


One can easily imagine that the radiation pattern for this antenna is not the symmetrical figure-8 we saw earlier . . .

Similarly, we can presume that this popular "under-the-wingtip VOR antenna might exhibit some "favorite directions" relative to the airplane.

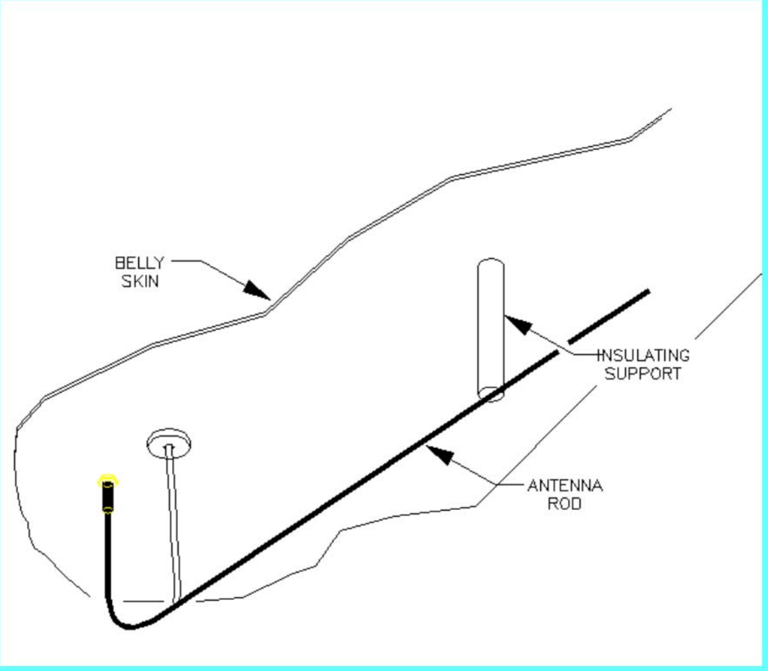


A dipole is a symmetrical two element device that is best fed with a balanced transmission line not unlike the flat “twin lead” popular for television antennas some decades ago. Coax is an Unbalanced feedline. An balanced antennas performance can be enhanced by making the transition from coax to the balanced antenna with aq device called a “BALUN”. See http://aeroelectric.com/articles/BALUN/Balun_Fabrication.html



Marker Beacon Antennas are looking for a 75MHz transmitter that is 1000' or less below the aircraft. Markers have VERY strong signals.

Many light GA aircraft use the "sled runner" antenna easily fabricated and attached to the bottom of the empennage. $high$ aircraft may use a more compact, molded plastic "canoe".




This is a "clamp and solder" style BNC male connector. Center pin is soldered. Shield braid is clamped into place with a combination of nut, washer, gasket and shield clamp.
Over 40 years old and not a "bad" choice but it does take some practice to install it well.


Part No. S605BF
This is a crimp-on, bulkhead mounted female BNC connector. Useful at wing root disconnects for wing mounted antennas.


This is a crimp-on, cable female BNC connector. Useful at wing root disconnects and "maintenance friendly" coax runs.
Part No. S605CF


This is a "crimp-on" or "solderless" BNC male connector.
Both center pin and shield braid sleeve are attached using
proper crimp tool. This is the coax connnector of choice.
Part No. S605CM