Good ideas are not necessarily complicated or expensive. NA7K comes up with another antenna project—a circular polarized array for listening to and perhaps working the orbiting space shuttle.

The Turnstyler

A Circular Polarized 2 Meter Antenna

BY DAVE PLANT*, NA7K

The "Turnstyler" is an easy to duplicate circular, polarized, self-supporting array developed by a group of amateurs in the northwest. Our challenge was to attempt to improve on the classic turnstile antenna to try to hit the upcoming orbiting space shuttle and other space objects.

The classic turnstile consists of two horizontal dipoles crossed at their centers and fed 90 degrees out of phase so they do not interfere with each other. The dipoles, each sharing power, gave a horizontal omnidirectional pattern that was valuable in previous v.h.f. work. Horizontal polarization does result in less reception of man-made QRN. Also, there is an "edge effect" that does appear to benefit horizontal polarization somewhat more.

The interest in the turnstile antenna has returned because circular polarization is valuable in space communication. Fig. 1 shows the basic configuration of the two dipoles. Dipole "A" gets fed. Dipole "B" then gets its half, 90 degrees later. The arrow shows the direction of activity. Conventionally, the direction of the arrow has been controlled by mechanically changing the array or switching the feedpoint connections. This is where KA7AEF suggested we attempt to find a simple mechanical method to turn the driven elements upside down. The analogy is taking fig. 1 and looking at the circular arrow from the other side. It does go from ccw to clockwise.

Mechanical Considerations

The solution was to create a turnstile arrangement that could be reversed. The problem was reversing everything. The answer was to create a driven section that could be reversed at will, yet have a dedicated reflector that would keep its reflected pattern, encouraging upward transmission. Fig. 2 shows the solution. The reflectors are part of the mast and always stay in position. The upper driven element section can be reversed at will, depending upon which circular polarization makes best copy. A good test of this is that typical QSB type sound is reduced measurably.

The author takes the Turnstyler out for a mobile run.

Looking at the photographs, a small mini-box is shown. The author used this to tie the matching section of 50 ohm coax to whatever direction of the Turnstyler was headed downward. PVC was used primarily to keep the cost down to about $5.00 and because it was readily available.

Performance

It was a sunny August day when the bottom line was checked. KA7AEF brought his multi-mode 2 meter rig, a Daiwa s.w.r. bridge, and a 200 watt out class AB2 power amplifier. The author also had on hand a Bird model 43 and a pair of 4X150A's. The computer said that OSCAR 10 (Phase 3B) was in sight, and we went shopping for it.

Richard found the beacon signal tumbling away, and we reversed the "sense" of the Turnstyler and copied several states far removed from our northwestern Washington state locale. Not yet convinced, Richard, KA7AEF, brought in a wide-spaced 11-element array and a 3-element job. My wife, Carolyn, watched us fit his antenna gear through the house to the back porch and was polite enough not to ask why two grown men were doing such a silly thing.

The next test was running 200 watts into the thing and checking s.w.r. The Turnstyler was happier at 144.5, and a hacksaw was necessary to take off a quarter inch on the driven elements. At the 200 watt level the s.w.r. was flat using good-quality RG59/U.

Final Thoughts

In conclusion, we learned as we followed OSCAR 10 down to the horizon that

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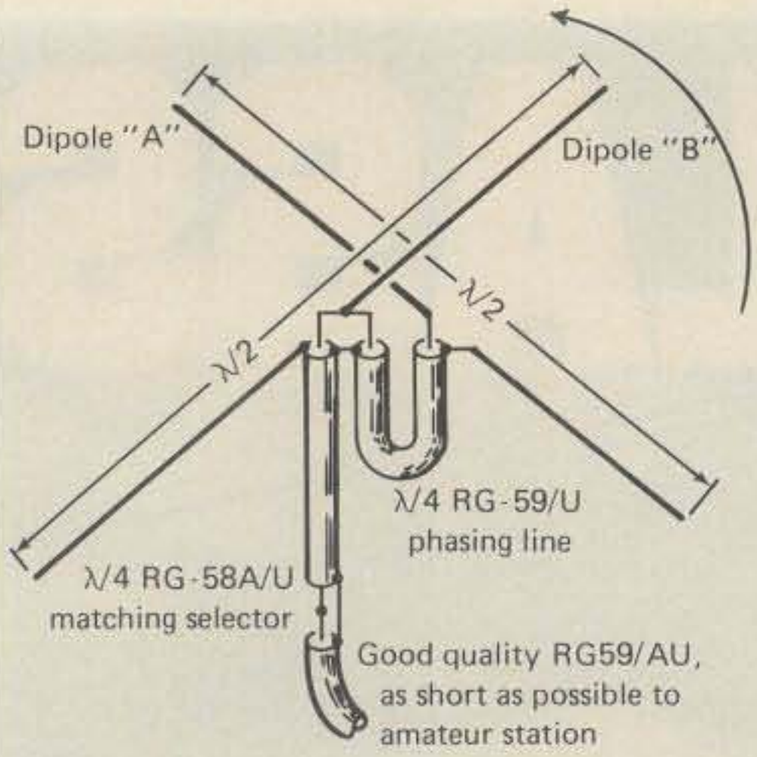
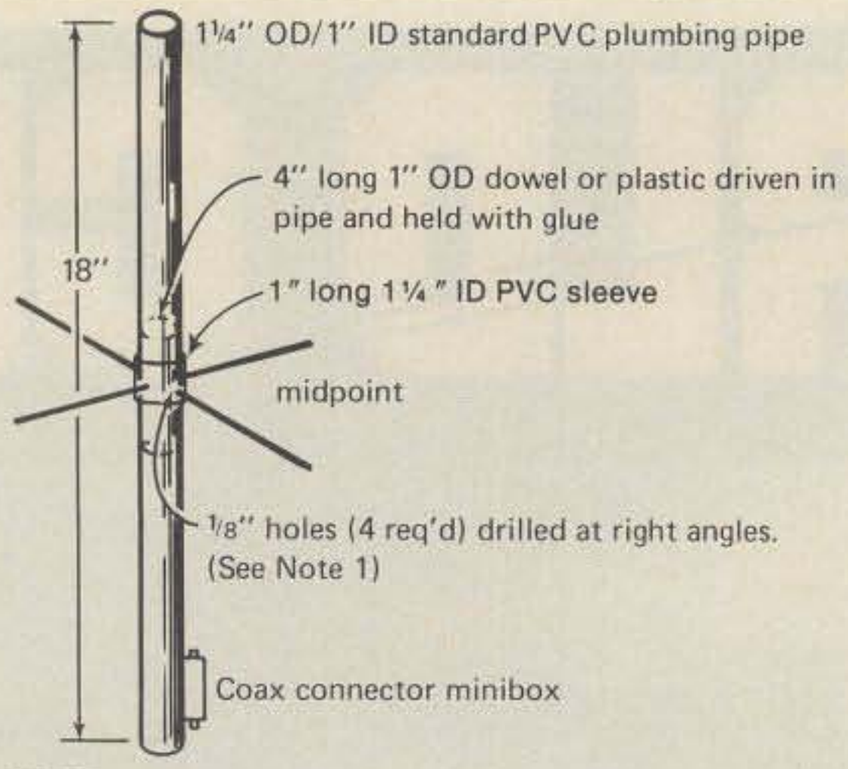


Fig. 1– The electrical configuration for the driven elements of the Turnstyler antenna. As mentioned in the text, the circular arrow shows the circular "sense" of the antenna when constructed in this manner.



NOTE:
1. These holes are then tapped to accept 8-32 threaded rod. The rods are threaded in and locked into place with nuts. Additional washers are added to fit the feed and phasing lines and secured with washers.
2. Driven rods are all 19" long.
3. Upper turnstyler is reversed to change sense

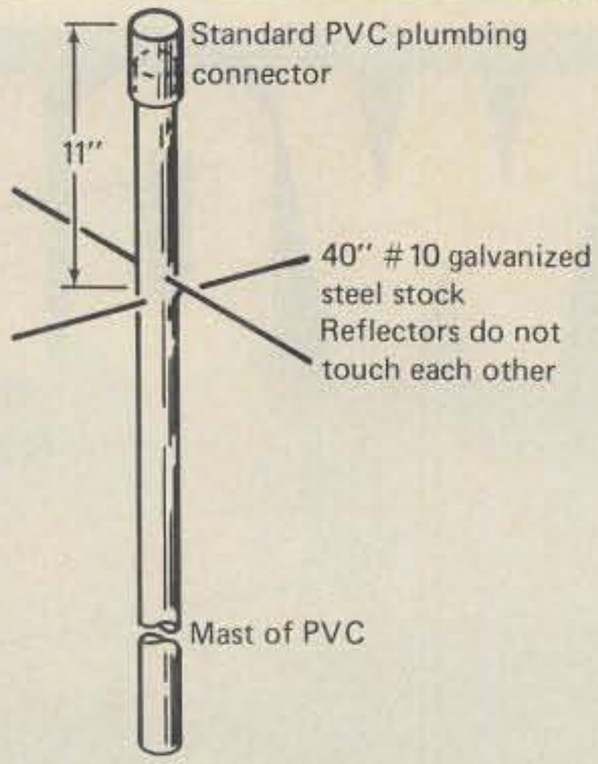
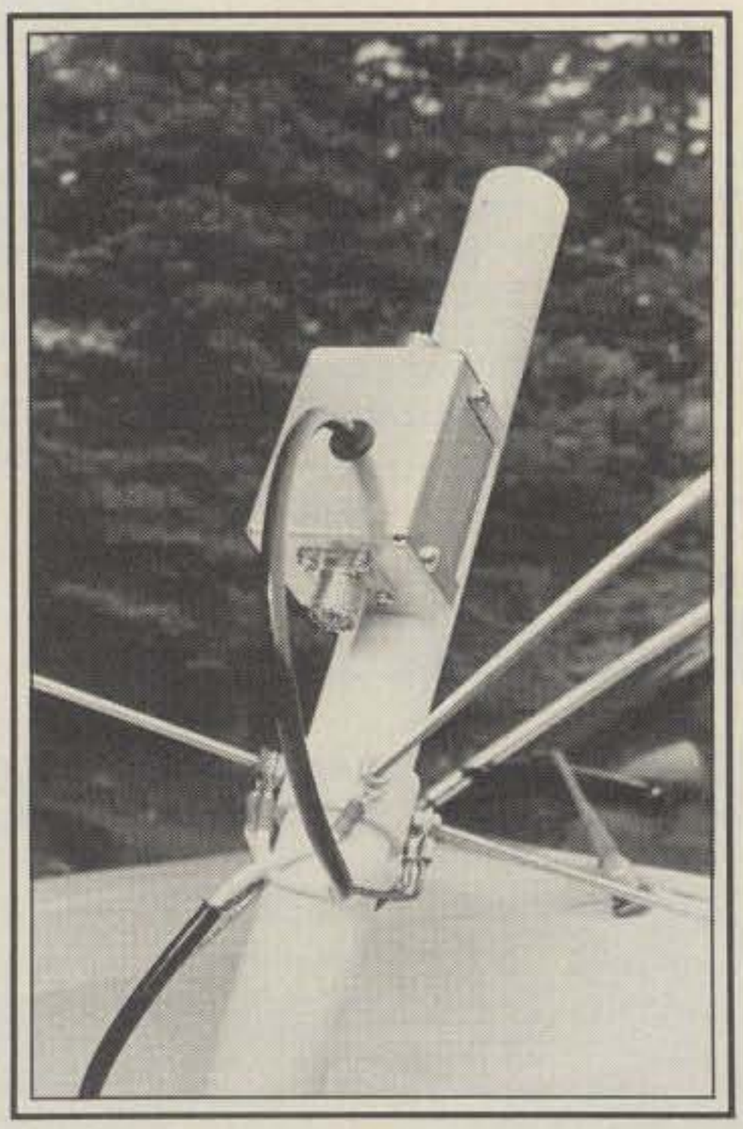


Fig. 2– Mechanical details for constructing the Turnstyler antenna. The minibox contains only two SO-239 connectors in parallel, with the RG-58 A/U quarter-wave matching section connected—through a grommet—to them. There is no electrical significance to the box.



Close-up view of the 8-32 threaded rod assembly. The four rods are cut to 20 inches and then trimmed back via fine tuning. Make sure that the four rods do not make contact within the PVC and internal dowelling.

Fig. 3– Mechanical details for the phasing and matching leads. Be sure to avoid reversing the center conductors and shield leads when attaching these lines to the driven elements.

nearby trees greatly absorbed the signal. However, for most applications where the bird is overhead, and as the next space shuttle passes overhead, a simple unobstructed location on the house roof or in the backyard seems to work fine. We also learned that the spacecrafts do indeed change "sense." My guess is that the Faraday matter has something to do with that.

As I mentioned earlier, many amateur operators were involved in this project. Richard, KA7AEF, came up with the driven-element reversal to change circular "sense." John, N7AHX, developed the method of attaching the driven elements to the reversible PVC section. Howard, W7GFU (my father), came up with the idea of keeping the reflectors separate. Ivory, N7CHN, took the photographic responsibility. John, WA7HEE, loaned test equipment. Jim, W7SFX, provided the necessary theory. Last, but not least, Bob, K7ZBF, provided encouragement and chained this writer to the wordprocessor until the job got done.

The 2 meter and 450 MHz gear was provided by ICOM, and Cushcraft provided the 450 MHz uplink antennas. Turnstyler is now trademarked by Benchmark Research, Inc. CQ

Ivory, N7CHN, is shown examining the phasing section of the driven assembly. Ivory took the photos of the project.