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By Paul Danzer, N1II

A 6 Meter Halo

Following up on last month's look at the 50 MHz band, here's a practical antenna.

75 + 03 = 6

That's a strange equation—but no stranger than 6 meters, not quite an HF band and not quite a VHF band. The *03* in the equation is the year this antenna was built. The *75*? One of my old *Handbooks* is a prized (at least by me!) 1975 *ARRL Handbook*, an edition that includes a description of a *6* meter halo.

The last time I was on 6, my rig was a *Benton Harbor Lunchbox*, as we called the inexpensive Heath transceivers of the time. Now I wanted to use the 6 meter capability of my new rig, but there was no room on my house for another rotatable antenna. The list shows what I was looking for. It turns out that a halo was an obvious choice.

1. Inexpensive (okay…cheap)
2. Omnidirectional
3. Horizontal polarization to be able to work locals
4. Only one trip to the nearby home supply store
5. No exotic components to be ordered
6. Easy to tweak without 6 meter test equipment

The 1975 Handbook Design

Figure 1 is a copy of the *Handbook* design; the accompanying table is the list of dimensions. The halo is described as basically a half-wave dipole, bent into a circle. As I later found out, with the dimensions and matching capacitor as shown, my halo had an SWR of less than 1.2:1 at 52 MHz—quite a bit higher in frequency than the 50.000 to 50.600 MHz suggested by the ARRL band plan.

Now that I had an idea what the antenna looks like, a trip to the local home supply store turned up 20 feet of copper tubing for around $15 and $^{3}/_{4}$ inch PVC pipe with fittings under $2 each and some fittings under a dollar. The result is shown in Figure 2. Note that the PVC mounting structure is not quite symmetrical. Lesson learned—when you paint on the PVC adhesive and insert the PVC pipe in the fitting, make sure it is *exactly* where you want it the first time. Once the pipe is

Figure 2—The halo from the rear. A copper strap connects the matching section to the halo on the left.

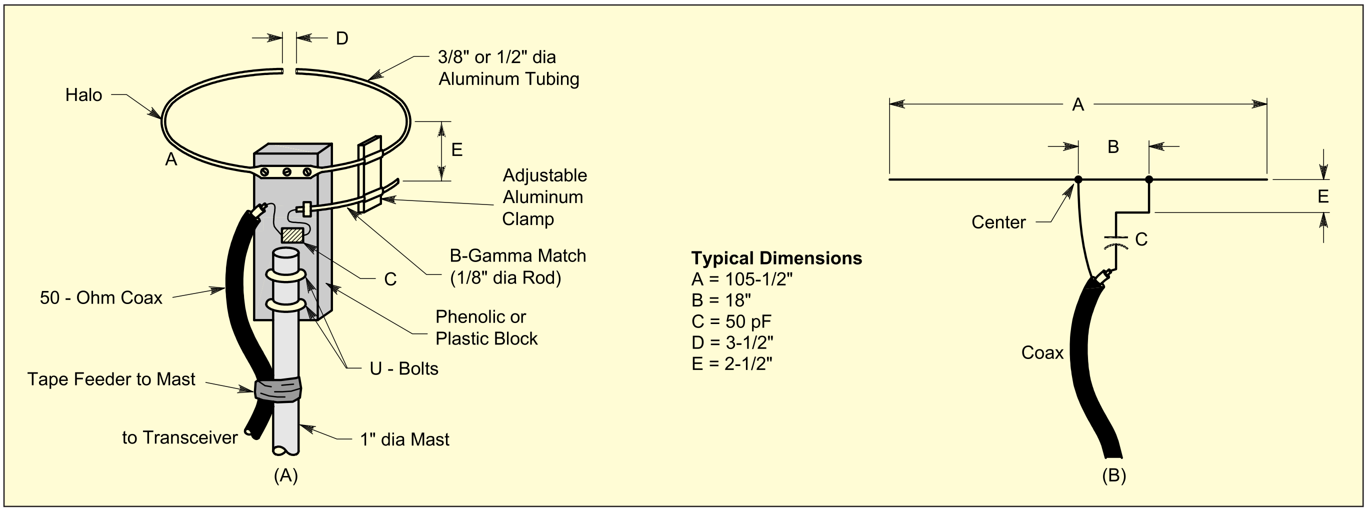


Figure 1—The 6 meter halo, as published in *The 1975 ARRL Handbook*.

Figure 3—A block of wood and a hammer was the precision tool used to flatten the far ends of the halo.

Figure 4—Details of the feed connection. The flattened tube approach could be used instead of the clamp shown on the loop on top.

Figure 5—The loop mounting structure. A word of caution—plan how you will assemble the square carefully. With PVC adhesive, you don't get a second chance!

inserted, the adhesive action is nearly instantaneous—you cannot move or turn the PVC pipe or fitting; it's there forever!

A question arose: What to bend the dipole around to get a circle? Actually, you will find the tubing is quite stiff. If you bend it by hand, it will come out very close to a circle—by itself.

The center of the dipole is mounted with a 1/2 inch copper pipe bracket. Simply flattening the middle with a hammer and block of wood, as was done at the ends, however, would be my construction choice next time. Then a single screw would be enough to mount the center of the halo. A PVC T is used to fasten the vertical pipe to the horizontal stiffener pipe. The top end is left open, so you can add more structure above the antenna later if you want to—perhaps a second halo for 2 meters.

The center mounting and feed arrangement is shown in Figure 3. Braid connects the coax fitting outside to the center of the halo (on top), and two capacitors in series are shown connecting the center of the SO-259 to the matching element. The two capacitors were later replaced by a single capacitor. The coax connector is mounted on a junkbox piece of stiff aluminum grill material.

The far end of the loop is shown in Figure 4. An X fitting was used, although a plain T would have done just as well. Two short pipe stubs are glued into the sides of the filling, and the copper tubing screwed to the pipe stubs. The two ends of the loop were flattened with the hammer and a block of wood.

The *Handbook* text suggests tuning can be done by changing the size of the gap between the loop ends. To try this tuning method, you could extend the two stubs. Then by taping (temporarily) the copper tube ends to these stubs, you could see the effect of changing the gap. If you are satisfied with results, mark, drill and screw it together.

The PVC supporting structure was made in the form of a square, slightly less than 18 inches on each side. The left side pipe in Figure 5 is strapped to the tower, and thus the loop is separated from the tower by about 18 inches. For top mounting, you can skip the structure to the left and just use a single piece of pipe.

Major Parts List

1 roll of 1/2 inch OD copper tubing. Normally available in 20 foot rolls. If you measure it, it actually measures very close to 1/2 inch in outside diameter.

Two lengths of 3/4 inch *schedule 40* PVC pipe. Normally white, it comes in 10 foot lengths, and actually measures approximately 1 1/32 inches OD. You might get away with only one 10 foot length, but any left over makes fine insulators for future projects.

Fittings for PVC pipe:

2—L fittings

4—T fittings (an L fitting may be used for one of the T fittings, if you do not plan to add a second 2 meter halo on top of the 6 meter unit; see text)

6—copper 1/2 inch pipe clamps. Four are used to connect the end of the gamma match to the dipole with a short length of copper braid. Once you have the antenna working, you could remove the clamps and using a torch, solder the braid directly from the gamma element to the dipole. Two clamps connect the ground side of the SO-239 to the center of the dipole. As shown, one of these clamps has a hole drilled in its center and is bolted to the PVC pipe through this hole. As the text says, these clamps may be eliminated by flattening the dipole at this point and, after drilling a hole in the flat area, bolting it (and the connecting braid) directly to the PVC pipe.

1—SO-239 coax socket, plus stiff hardware cloth or aluminum to hold the socket.

Approximately 12 inches of copper braid (tinned).

Matching capacitor—see text.

Assorted screws, lock washers and nuts. Common practice is to claim that only stainless-steel hardware should be used. I generally use junk-box hardware, but only after washing the hardware with a degreaser, then detergent and water. After drying it well, I assemble the antenna and then coat the hardware with an outdoor paint product (spray Rust-Oleum is a good choice). I have even successfully used spray Krylon. No, it won't last forever, but few of my antennas have a lifespan of over 5 years or so—after that I get bored with them.

Tuning and Matching

The halo is basically a half-wave dipole, bent in a circle. Since no insulator is used to separate the two sides of the dipole, a gamma match connects the 52 Ω feed to the dipole.

The only 6 meter instrumentation available to me was the SWR position on the rig. A 1970s vintage Heathkit VHF power meter/SWR bridge later verified the SWR readings, however. Somehow this piece of test equipment seemed appropriate!

To tune the antenna system, a variable capacitor was used in place of the two series capacitors shown in Figure 3. The final value, under 20 pF, resulted in an SWR of less than 2:1 over the range of 50.000 to 50.400 MHz—fed with LMR400 cable.

The only difficulty was finding a capacitor of the correct value (or close to it) with a voltage rating of a few hundred volts. Most capacitors available in retail stores these days seem to be rated at 25 or 50 V—not a good choice for a 100 W input. A healthy covering of Silastic was put on the exposed SO-239 connector and the feed capacitor. The presence of the Silastic did not seem to affect the SWR, and should provide a degree of waterproofing.

Performance and Future Plans

The final step in any antenna project is to see how well it works. As soon as I could, I raced down to my shack, ran the feed line through the door and anxiously tuned to band to see what I could work. And the answer was—nothing! It was 3 o'clock on a rainy June afternoon. Most people were either at work or, if they were home, had the sense to take a little siesta. But, of course, that evening and the next morning, the proof of the antenna's performance is in my log.

As for the future? For the most part I used brass screws and bolts. Replacing them with stainless would be a good idea. One trick I've used for years is to spray all hardware with an outdoor varnish. This seems to prevent corrosion for a few years.

The next step? Perhaps a 2 meter version, stacked over the 6 meter unit. But first I will have to get another rig...

Photos courtesy of the author.

Paul Danzer, N1II, has been a licensed ham for over 50 years. Paul has both Bachelor's and Master's degrees in EE, and after many years as an electronic engineer, he now teaches at Housatonic Community College in Connecticut. When he was on the ARRL HQ staff, Paul wrote and edited ARRL books. He is also an ARRL Technical Advisor. He can be reached at 2 Dawn Rd, Norwalk, CT 06861; **p.danzer@ieee.org**.

NEW BOOKS

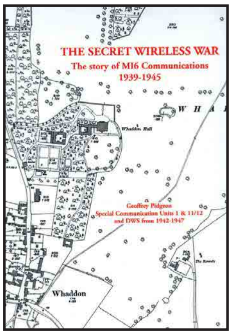
THE SECRET WIRELESS WAR THE STORY OF MI6 COMMUNICATIONS—1939-1945

By Geoffrey Pidgeon

Published by UPSO, London, UK. 416 pages, $8\frac{1}{2} \times 11\frac{1}{2}$ inches, 194 black-and-white photographs and illustrations. ISBN 1-84375-252-2. Available from the ARRL, order no. 9437, $54.95 plus shipping. Order toll-free 888-277-5289 or order on-line at **www.arrl.org/shop**

Reviewed by André Kesteloot, N4ICK, ARRL Technical Advisor

◊ If you enjoy old tube radios, World War II stuff, true espionage stories with lots of fascinating details and photographs of wonderful communications equipment, this book is definitely for you. What Geoffrey Pidgeon has put together is a book replete with personal memories, photos of people and equipment he worked with while enrolled in MI-6 during WW II, and chapters written by specialists such as Siegfried Maruhn, an Enigma operator for Rommel's Afrika Korps (who eventually ended up, in 1988, as the White House correspondent for several West German newspapers) or based on extensive debriefings of long-time MI-6 employees such as Pat Hawker, G3VA, of *RadCom* Technical Topics fame.



In 1942, the author joined Section VIII of MI-6 as an apprentice and found himself working at the Bletchley Park/Hanslope Park complex, where Enigma-encrypted German Abwher transmissions were intercepted, deciphered, labeled "Ultra" and finally relayed—by riders on motorcycles—to a very few authorized readers. The author rose through the ranks, first drilling holes in metal chassis, then wiring radio sets, and finally installing them in automobiles and airplanes. The book also includes introductory chapters, to name but a few, on British Intelligence through the ages, encryption, black propaganda and a 500 kW medium-wave transmitter originally built by RCA for WJZ in New Jersey but eventually installed in the UK.

This volume—an album that has taken six years to compile and produce—is a remarkable compendium of human stories related to these heroic years when the interception of radio transmission to and from spies of both sides would determine the outcome of gigantic battles and decide the survival, or death, of tens of thousands of men.

One of the appendices is devoted to the description, with many photographs, of the various transmission sets that were issued to British agents working overseas. Old timers, in addition to watering at the mouth over the photographs of "suitcase transmitters" sporting RCA metal tubes and beautiful dials, will relish the photographs of the 1940 Packard Sedans that were converted to mobile wireless units, each fitted with a short-wave transmitter built at Bletchley Park and an HRO receiver.

If, perchance, your bookshelves were to be, like mine, already saturated, this book could certainly find its place on the coffee table.

STRAYS

TONY ENGLAND, WØORE, HONORED BY IEEE

◊ Former shuttle astronaut Dr Anthony W. England, WØORE, of Dexter, Michigan, has received the 2004 IEEE Judith A. Resnik Award. Tony received the award, according to the IEEE citation, "For significant contributions to the development and application of spaceborne microwave radiometry to remote sensing." The award is named in honor of IEEE member Judith Resnik, who was an engineer and a NASA Mission Specialist on the shuttle *Challenger*, which exploded in 1986.

Better known as Tony to hams around the world, Dr England was the second astronaut to operate ham radio in space. A mission specialist on the *Challenger* in August 1985, his NASA biography lists his recreational interests as "sailing and Amateur Radio." Tony was behind the thrust to adopt the acronym SAREX for the Shuttle Amateur Radio Experiment program. His goal for the program was to heavily weight it toward contacts for boys and girls and schools in order to interest them in science and Amateur Radio.

Owen Garriott, W5LFL, the first astronaut to use ham radio in space, back in 1983, pioneered, along with Tony and Roy Neal, K6DUE (SK), the successful campaign to incorporate Amateur Radio stations aboard shuttles. Their knowledge, experience and influence helped get approved, built and then operating the equipment that allowed hams to understand, to some extent, the thrill of space.

Tony, who holds an Amateur Extra class license, is an electrical engineer and computer scientist. He is currently a professor of atmospheric, oceanic and space sciences at the University of Michigan. He was a graduate fellow at MIT prior to being selected as a scientist-astronaut by NASA in August 1967. He helped develop and use radars to probe the Moon on Apollo 17, and has led field trips in Antarctica to study glaciers. He was co-winner with Garriott of the 2002 Dayton Hamvention Special Achievement Award. *—Rosalie White, K1STO (tnx Charlie Sufana, AJ9N, for spotting the IEEE news item)*