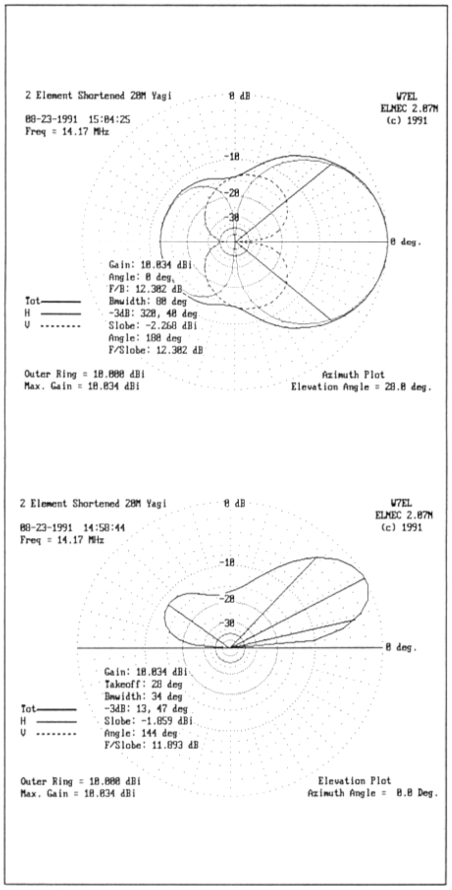

Figure 2. a) Azimuth plot of the yagi using the ELNEC program. b) The elevation plot.

believe me, this antenna is a good match to 52 ohm coax!

3. **Q (Bandwidth)** An electrically-shortened antenna also exhibits higher Q than its full-sized counterpart and this means less usable bandwidth. I wanted optimum performance, primarily within the frequency range of 14.150 to 14.225 MHz (where I hear much of the DX I'm interested in). I received an unexpected bonus when I modeled the antenna, and then constructed and tested it. Analysis showed a far better bandwidth than I had sought, and the finished antenna produced a full 350 kHz bandwidth with low SWR when measured at the transmitter end of the feedline.

Subsequent remodeling and investigation suggests that the additional bandwidth results because of two reasons: Loading coil *Q* is lower than originally modeled (fortuitous because of the "low-profile low-wind-load" form factor I had chosen); and attenuation exists in the 50 feet of RG-8 coax needed to bring the antenna into the shack. You'll find that the attenuation of a random run of coax will yield lower SWR measurements at the transmitter than that measured directly at the antenna, and this serves to "pull down the end points" of the SWR curve. Figure 1 shows the broadband nature of this reduced size antenna.

The coax losses are sufficiently low as to be negligible for two reasons: The losses occur only at the edges of the frequency band of interest; and a tuner or matching network at the antenna also would introduce losses, and they would not be confined to band edges.

4. **Pattern** We'd all like to offer a "laser beam" to the world when we transmit, but I settled for reasonable front-to-back and front-to-side ratios with this antenna because of the constraints placed upon it. The front-to-back ratio varies from 12 to 18 dB, or 2 to 3 S-units in both ca!culated and on-the-air tests. With the Pacific to my back when beaming Europe or Africa, and the Atlantic at the flank when beaming the South Pacific and points west, it has proven to be a good choice. For stations at a reasonable distance, a distinct "null" appears off the sides of the antenna, probably due to the horizontally polarized signals predominating. (See Figure 2.) I'll admit that I placed pattern after gain when optimizing this yagi, but I have no difficulty determining when I point at a station (or its propagation path). This is very unlike a commercial "mini" I had occasion to operate from a friend's shack a few years ago, where it seemed we were turning a vertical! This antenna does have a usable pattern.

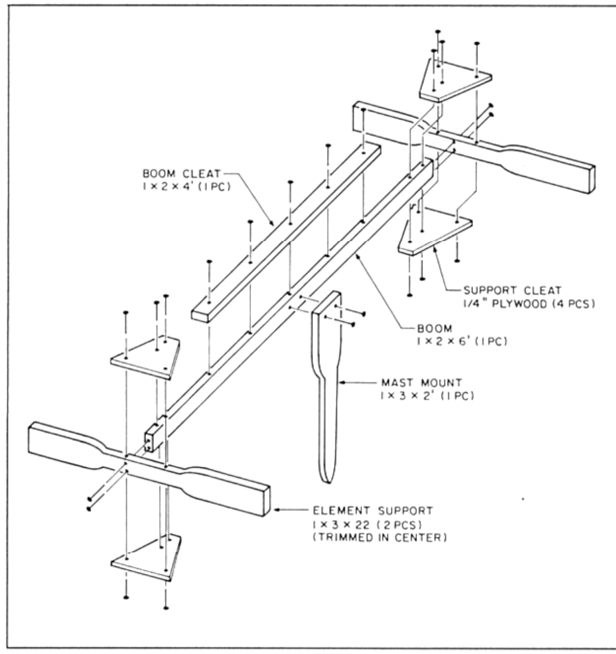

Figure 3. Boom assembly.

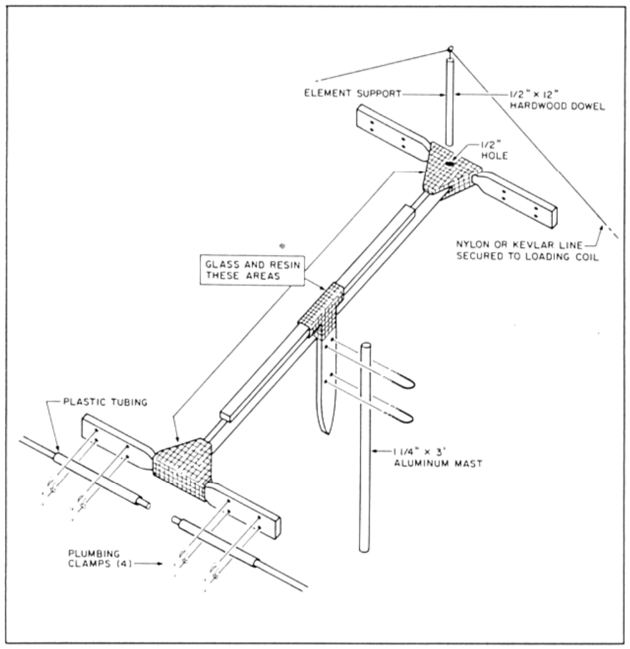

Figure 4. Glassing and final boom assembly.

Completed Design

Personal design constraint called for a total of 20′ element length, a spacing not to exceed 8′ (two elements), and maximum height above ground of 33′. The total antenna wind load and weight allow the use of an unobtrusive guyed push-up pole. The antenna that resulted from a few months of modeling on the computer has the following measured characteristics: element length = 20′; boom length = 6′; forward gain = 9+ dBi; F/S, F/B = >12 dB; and full band coverage with less than 1.7:1 VSWR.

Compared to its isotropic counterpart and using 1,200 watts input, this antenna provides an average of 12,000 watts ERP in the direction it is pointed. After examining the performance of many commonly used "antennas" on my computer, this, I can assure you, is a very strong signal.

Construction

Since the antenna was to be as unobtrusive as possible, I chose a wood and aluminum design for maximum structural strength commensurate with small size. I used a wooden boom (common fir) and reinforced it with fiberglass cloth and resin. This allows a good degree of flexibility, strength, and light weight for "pole" mounting.

I constructed the elements from 1/2″ and 3/8″ aluminum tubing, available at many hardware stores in 6′ lengths. These diameters are very small as common yagi elements go and have survived severe Florida winds without problem. This is probably because of the elasticity or "springiness" of the wooden boom elements. You cannot appreciate the small "willowy" nature of this antenna until you construct it.

Construction begins with the boom itself, shown in Figure 3. It is not wholly necessary to glass the joints, but you assure long-term reliability if you do. Kits for glassing are available from your local department stores (such as K-Mart) or automotive shops. These inexpensive kits contain enough fiberglass