LOG PERIODIC

ANTENNA DESIGNS FOR UHF/VHF

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The log periodic antenna was originally designed and proved at the University of Illinois in 1955. Since then, the military has been making extensive use of this tremendously versatile antenna concept. Until recently, few in the amateur fraternity have known about the log periodic principle.

Through the use of computer-aided design, I have developed three such antennas for use in the amateur bands. The dimensions for the three are given in Table I. All three antennas exhibit a forward gain of 13.5 dB with a front-to-back ratio of better than 15 dB over the specified frequency range. The swr is better than 1.8:1 over the specified frequencies.

The first antenna will cover the range of 21 to 55 MHz; the second antenna will cover 50 to 150 MHz; and the third covers 140 to 450 MHz. These antennas are designed with a 5% frequency overshoot at the low end and a 45% overshoot at the high-frequency end to maintain logarithmic response over the complete frequency range specified. In log periodic antenna operation, approximately four elements are active at any one specific frequency, thus the necessity for the low and high frequency extensions. All three antennas are

Table I. Spacing and Dimensions for Log Periodic VHF Antennas.

	21–55 MHz Array			50–150 MHz Array			140–450 MHz Array		
Element	Length, ft	Dia, in.	Spacing, ft	Length, ft	Dia, in.	Spacing, ft	Length, ft	Dia, in.	Spacing, ft
1	12.240	1.50	3.444	5.256	1.00	2.066	1.755	0.25	0.738
2	11.190	1.25	3.099	4.739	1.00	1.860	1.570	0.25	0.664
3	10.083	1.25	2.789	4.274	1.00	1.674	1.304	0.25	0.598
4	9.087	1.25	2.510	3.856	0.75	1.506	1.255	0.25	0.538
5	8.190	1.25	2.259	3.479	0.75	1.356	1.120	0.25	0.484
6	7.383	1.00	2.033	3.140	0.75	1.220	.999	0.25	0.436
7	6.657	1.00	1.830	2.835	0.75	1.098	.890	0.25	0.392
8	6.003	0.75	1.647	2.561	0.50	0.988	.792	0.25	0.353
9	5.414	0.75	1.482	2.313	0.50	0.889	.704	0.25	0.318
10	4.885	0.75	1.334	2.091	0.50	0.800	.624	0.25	0.286
11	4.409	0.75	1.200	1.891	0.50	0.720	.553	0.25	0.257
12	3.980	0.50	1.080	1.711	0.375	0.648	.489	0.25	0.231
13	3.593	0.50	0.000	1.549	0.375	0.584	.431	0.25	0.208
14				1.403	0.375	0.525	.378	0.25	0.187
15				1.272	0.375	0.000	.332	0.25	0.169
16							.290	0.25	0.000
Boom	25.0	2.0	0.5	16.17	1.5	0.5	5.98	1.5	0.5

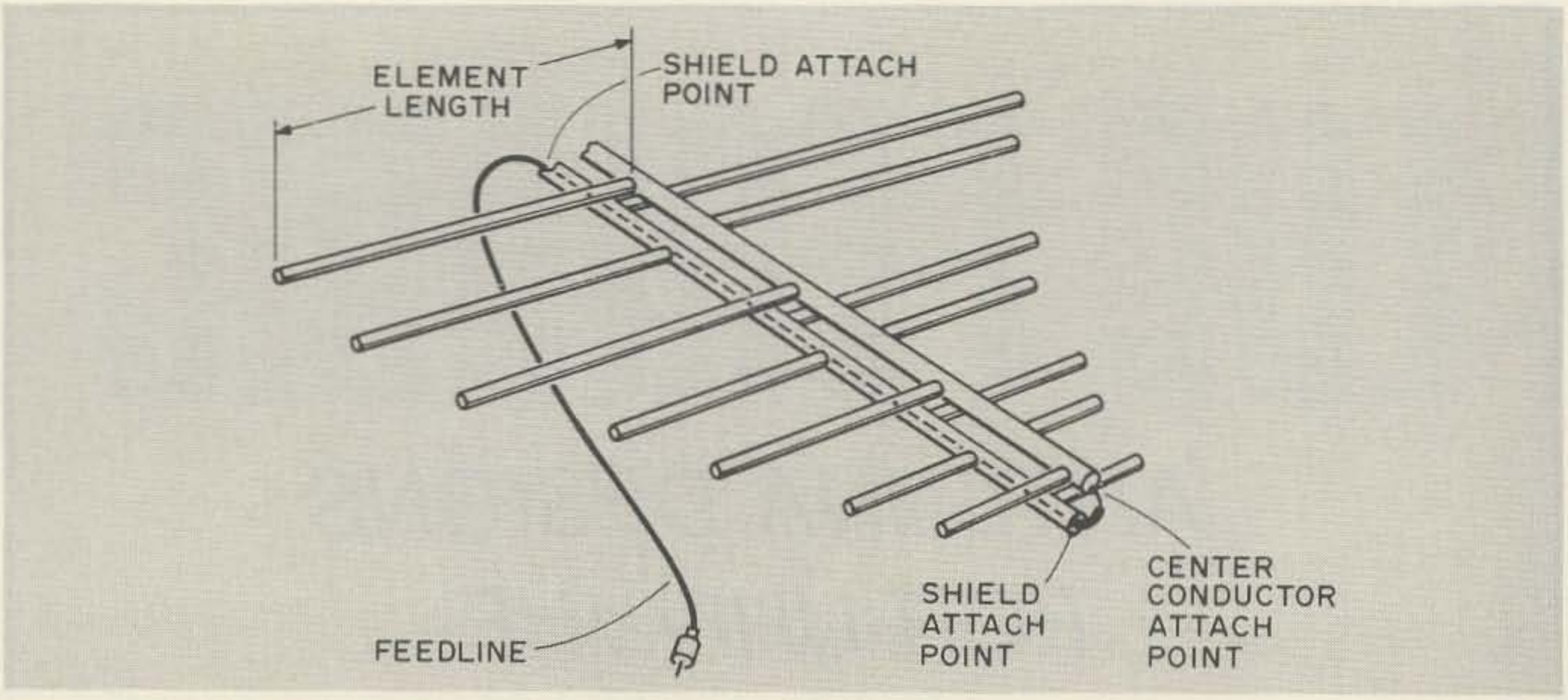

Fig. 1. Typical log periodic antenna. Note that the bottom is fed from the coax shield while the top boom is fed from the center conductor.

designed for a feedline impedance of 50Ω for use with coax such as RG-8/U. All of the antennas are design-rated for 1 kW, 100% modulated. The alpha, or logarithmic element taper is 28 degrees for all three antennas.

Construction

Construction is straightforward, and you can use your own ingenuity as far as fastening the elements to the boom, and also the dielectric spacer configurations. I used heliarc welding for securing the elements, and fiber glass for the dielectric.

Element lengths for the highest frequency antenna were calculated for the elements to be inserted completely through the boom, flush with the far wall. The two lower frequency antennas have element lengths calculated to butt flush against the element side of the boom. If the elements are to be inserted through the boom on these other two (21–55, 50–150 MHz), add the boom diameter to each element

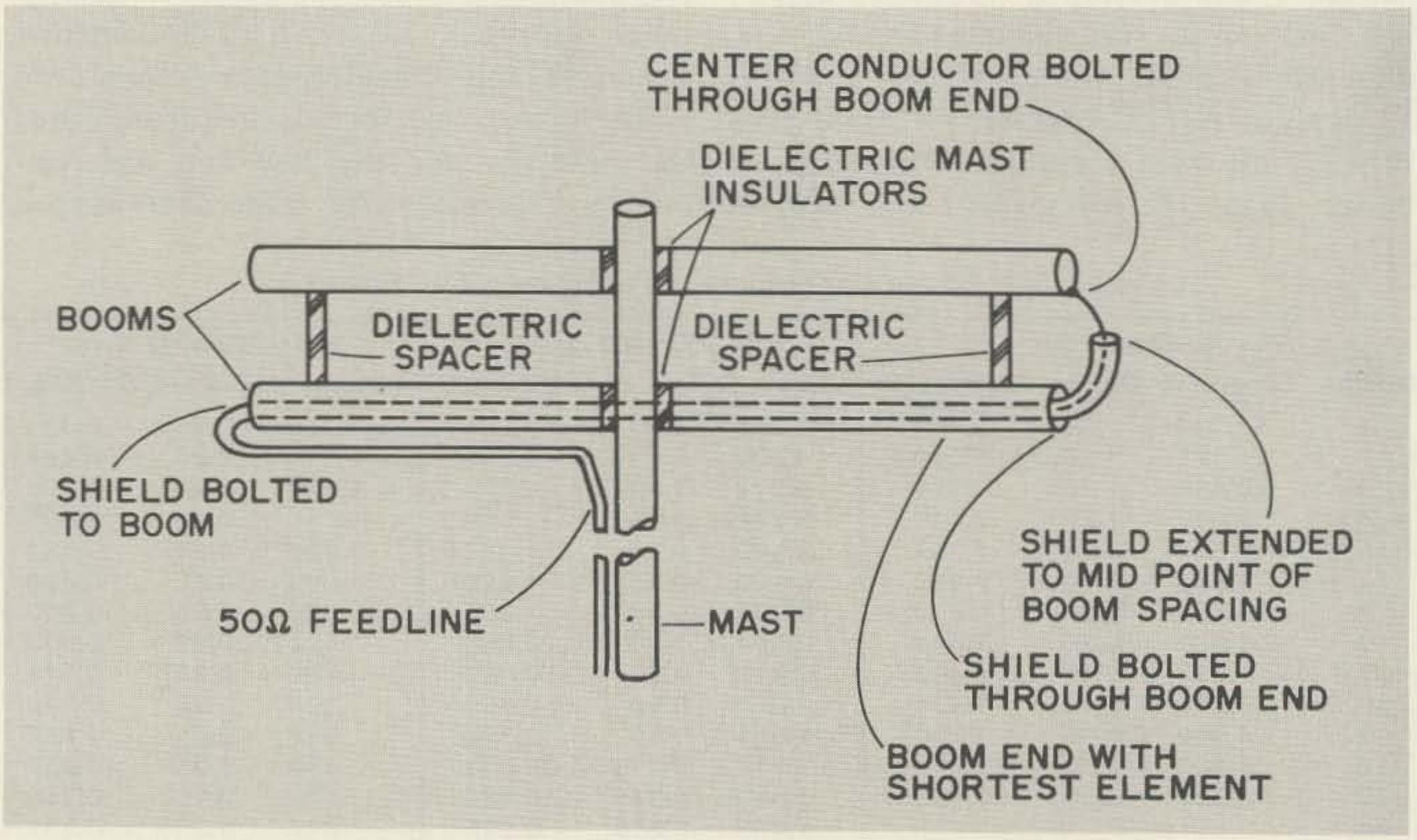

Fig. 2. Feeding the log periodic is relatively simple. Just remove the outer plastic jacket from feedline for the entire length of the boom, so that the coax shield is permitted to short itself inside the boom as well as the solid electrical connections at each end of the boom.

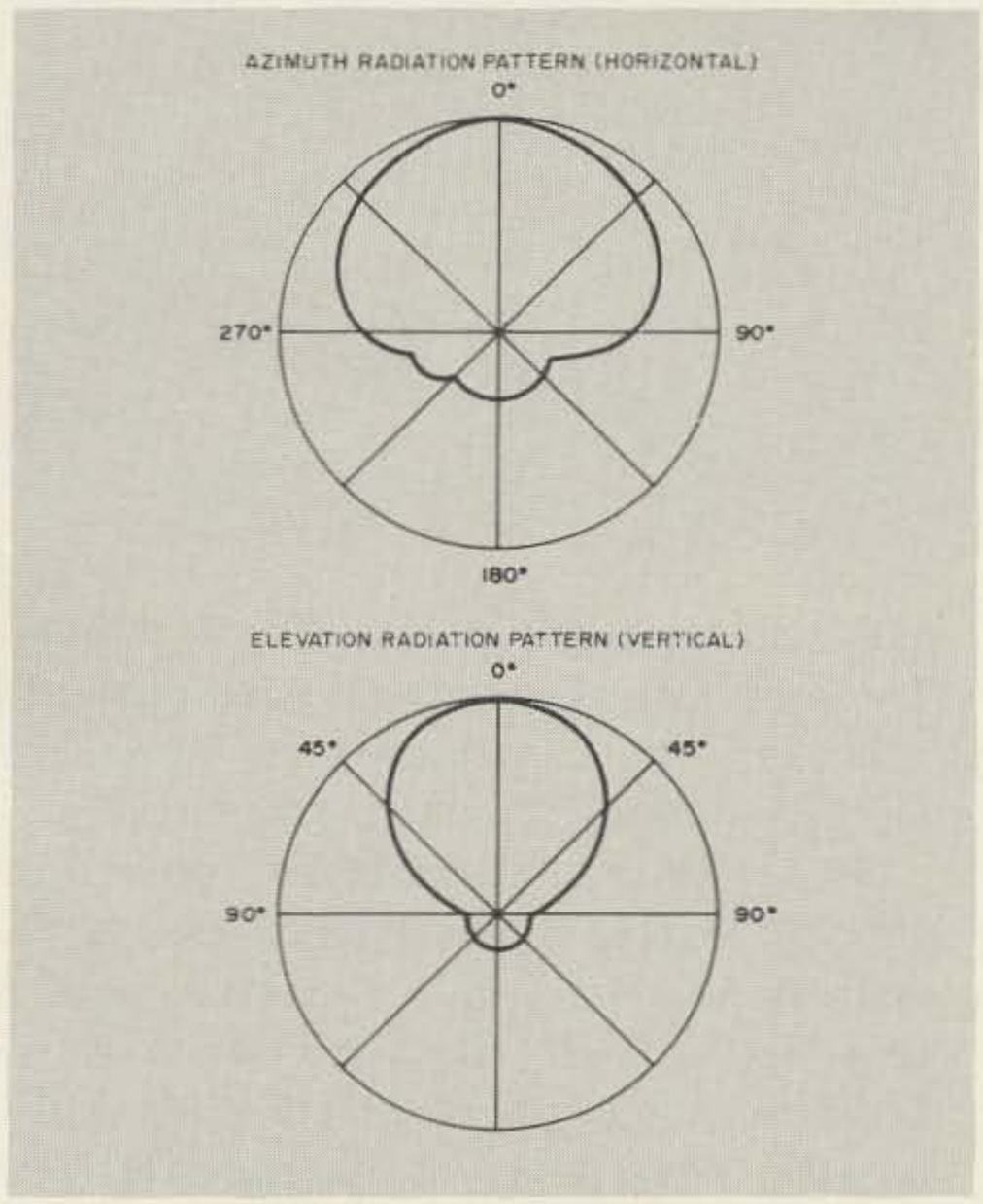

Fig. 3. Typical log periodic antenna patterns.

length shown before cutting the elements.

Two booms must be constructed for each antenna as shown in the isometric view of Fig. 1. Also remember, in supporting a log periodic antenna from a metal mast, the two booms must have a dielectric spacing from the mast of at least twice the boom-to-boom spacing; otherwise you will introduce discontinuities into the feed system.

Feedline insertion and connection are shown in Fig. 1.

Notes

Any change in the listed boom diameters will necessitate a change in the boom-to-boom spacing in order to maintain the feed impedance at 50Ω.

The location of the support mast is not critical; ideally, it should be at the array's center of gravity.

The antennas may be oriented either horizontally or vertically, depending on the type of polarization desired. The horizontal beamwidth of a typical log periodic antenna is approximately 60 degrees, while the vertical beamwidth is on the order of 100 degrees. These are the −3 dB points shown in Fig. 3.

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