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RADIO FUNdamentals

THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

A Bidirectional 6 Meter Wire Beam

In the pre-Yagi days (the 1940s) prominent DXers used fixed wire beams oriented in specific directions. On the east coast a popular combination was one beam aimed at eastern Europe and a second beam aimed at Japan. The first beam covered portions of the USSR and down into the middle-east. The second covered China, Japan, and the Philippine area. Areas out of the beam paths were covered by high dipoles.

My dream in high school was to have a beam. The first requirement was a brace of poles—telephone poles. Used poles were sold by many phone companies for about 10 cents per foot. You could talk a repair crew into picking out a nice pole. They would deliver it and plant it into a hole drilled in your yard. Total cost for a 40 or 50 foot pole was $10 or less!

The wire antenna of choice was the Lazy-H (fig. 1). This consisted of a pair of half-wave antennas, with a similar pair placed a half-wave below. The configuration was fed with an open-wire transmission line.

The Lazy-H had a bidirectional pattern with about 5.8 dBd gain. That's equivalent to a small, three-element Yagi. A Yagi would have been a more flexible antenna, because it could be rotated to any heading. However, in that time frame, information on Yagis was not readily available, and aluminum tubing was impossible to obtain, unless you lived near a southern California aircraft manufacturer and had access to surplus stock.

Close in popularity to the Lazy-H was the "flat-top beam," designed by W8JK. This compact wire beam antenna was used by a lot of fellows who didn't have room for a Lazy-H. But even the DXers equipped with multiple 8JKs envied the Big Guns with the Lazy-H beams.

So it was until World War II ended. After the war, when aluminum tubing was available at $2.00 per length and surplus RG-8 coax could be had for 6 cents a foot, the wire beam faded into obscurity, and the Yagi became the antenna of choice for most amateurs working the HF DX bands.

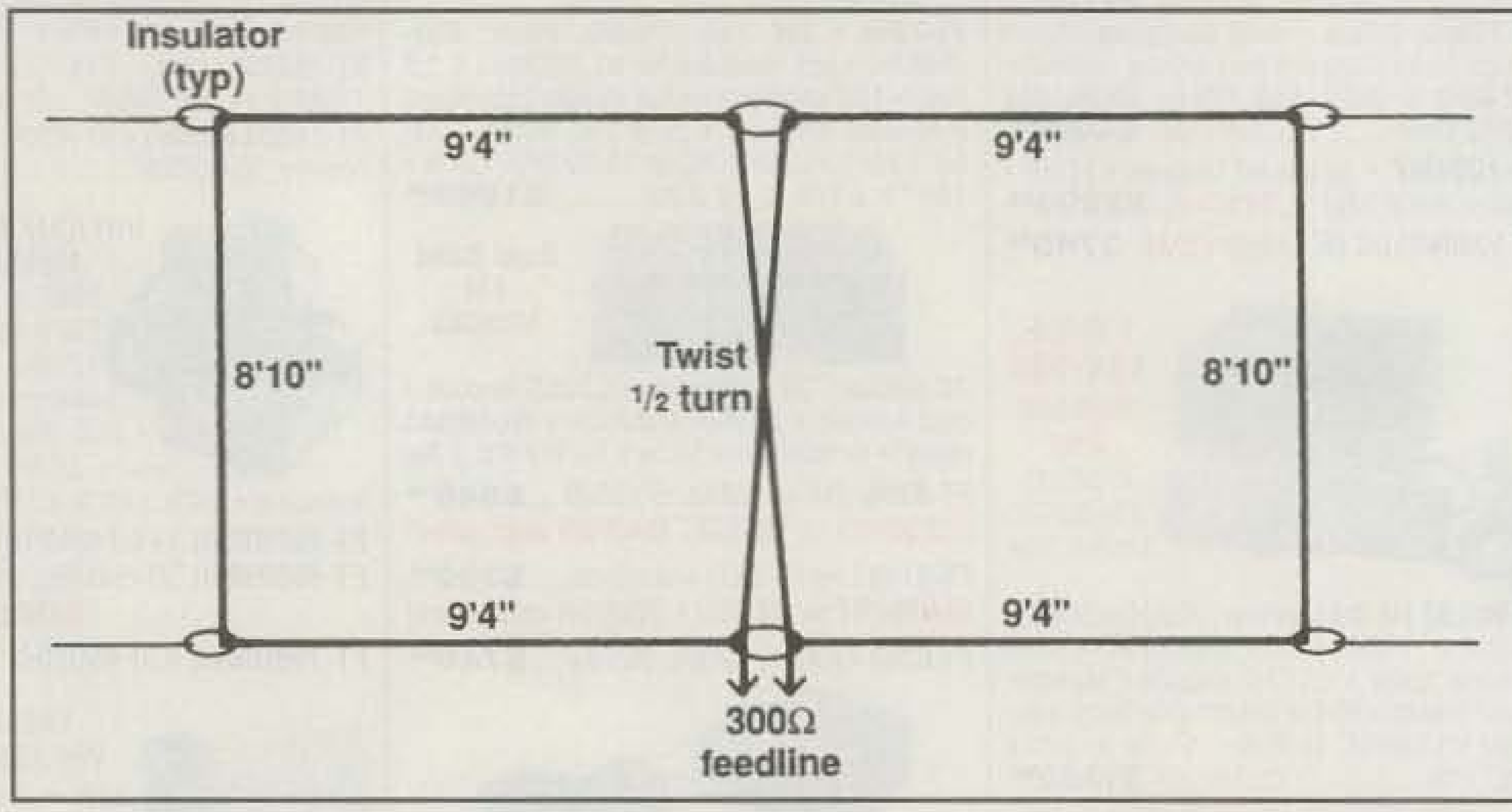

Fig. 1– The "Lazy-H" beam for 6 meters. The twisted transmission line is 450 ohm "ladderline." The beam fires into and out of the page.

Reviving Interest in Wire Beams

The wire beams occupy only a passing mention in most antenna handbooks. However, some alert 6 meter operators saw merit in wire beams. They were cheap, they were quite small, and they were nearly invisible.

The Lazy-H beam could be expanded by adding additional sections to it (fig. 2). These arrangements were developed about 1926 by engineers of the Bell Telephone System for their overseas HF radio links.

The key for maximum array gain and maximum bandwidth was to make the antenna symmetrical about the feedpoint. Additional experiments showed that with proper instrumentation, the array could be fed off-center (fig. 3), but this was not an approach to be taken casually. If not done properly, especially with respect to the feedline, antenna current phasing would suffer, along with antenna pattern and gain.

All things considered, the basic Lazy-H was a forgiving broadband beam. Larger arrays, in the main, were left to the professionals.

Interest in wire beams has recently been revived—not in the HF DX bands, but in the quasi-VHF band of 6 meters.

A Practical 6 Meter Wire Beam

The Lazy-H is an attractive 6 meter beam. It provides good gain and wide operating bandwidth. Part of the gain is provided by the stacked elements sharpening the pattern in the vertical plane, and the rest from the in-line elements narrowing the pattern in azimuth. Overall beam length is about 19 feet.

An effective use of the Lazy-H is for a repeater located near a busy interstate highway. The beam "fires" up and down the highway, restricting the pattern to where it is most useful.

The azimuth plot of the array is shown in fig. 4. It may be tempting to add more loops to form a so-call "curtain" array, but the additional gain is achieved only by pattern sharpening. Since the plot of the Lazy-H is about 50 degrees between the –3 dB points, the curtain would prove to be impractical, other than for a point-to-point situation.

Building The Lazy-H

It's easy to build this 6 meter beam. I made mine of #16 AWG enamel-coated, single-strand copper wire. Six insulators are required. The upper and lower wires are cross-connected by a transmission line made of a length of heavy-duty ladder line (sometimes called "window line"). The line I used was 450 ohm, 16 AWG, 19-strand copper-clad steel. It is quite flexible, easy to use, and less prone to bending fracture than single-strand wire.

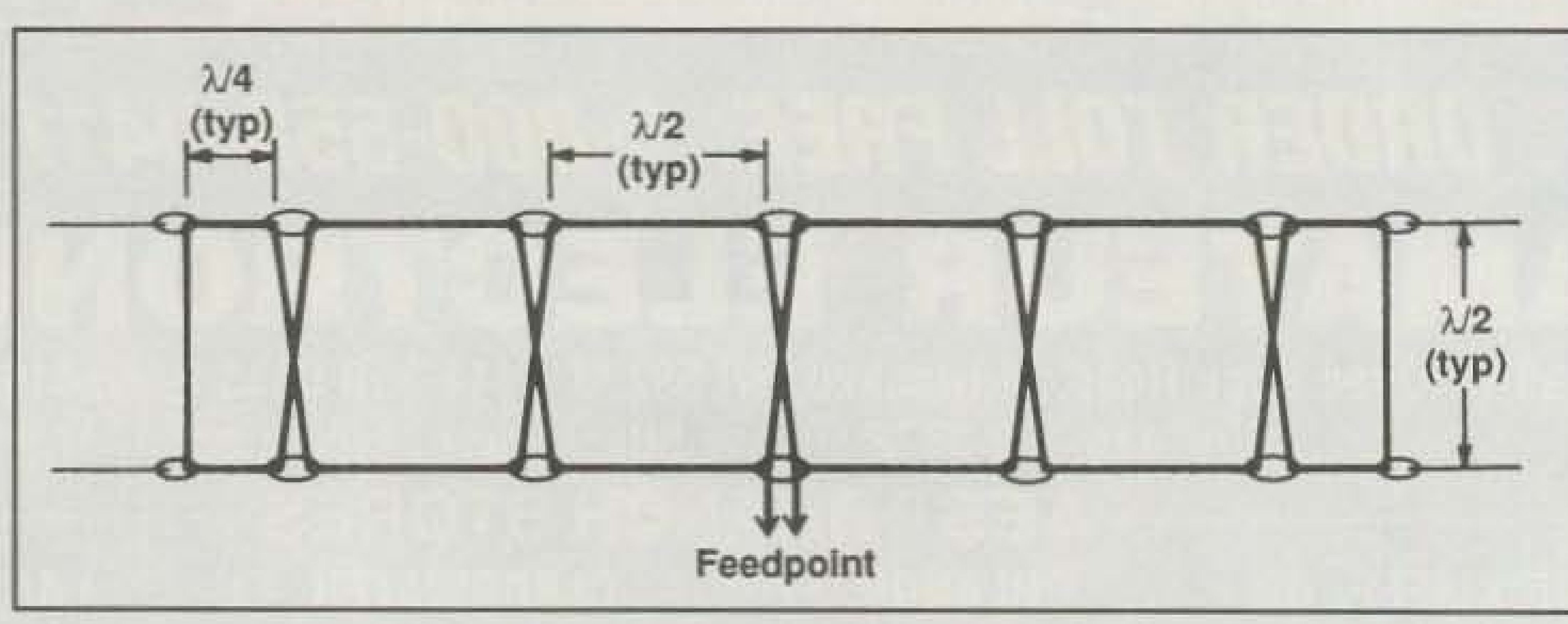

Fig. 2– Additional sections added to the Lazy-H provide a high gain, narrow beam for point-to-point service.

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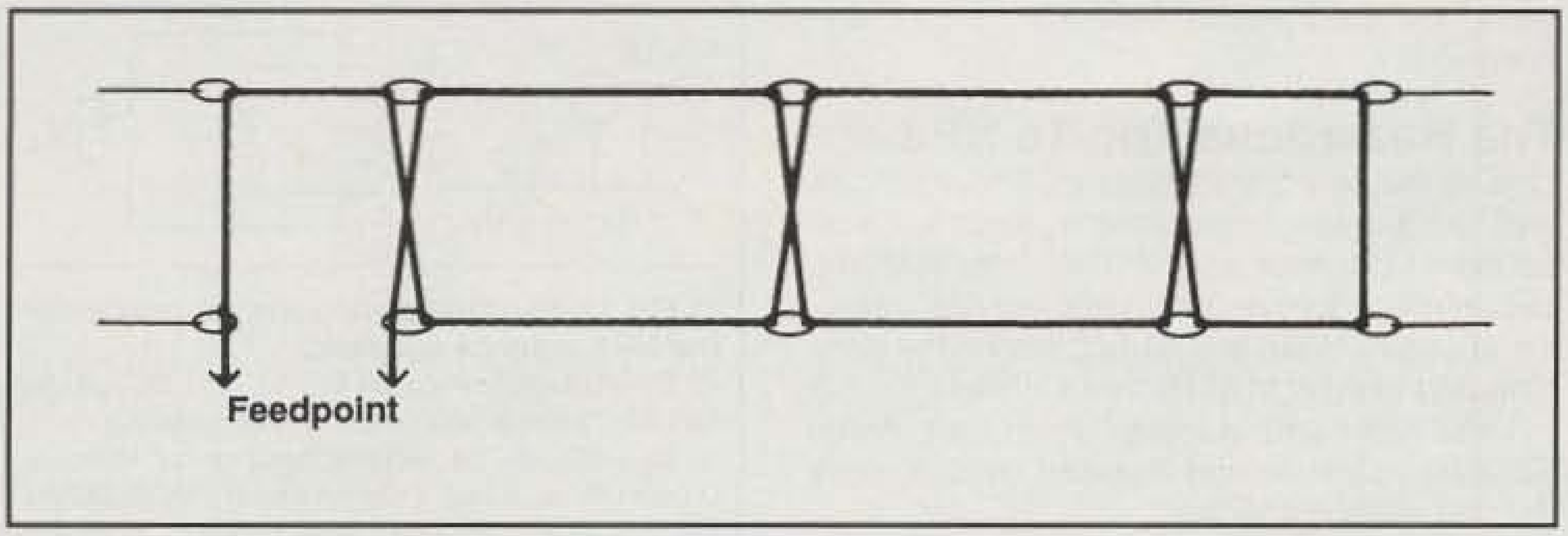

Fig. 3– Feeding the antenna at one end is tricky, as it is difficult to maintain proper phase relationships.

Remember when you build the antenna to allow enough extra wire length in the sections to wrap around the insulators and to join the adjacent section of the antenna. Solder all your connections.

The best construction technique is to assemble the beam at eye level, between two temporary supports. I used the garage and a handy nearby tree. It was easy to build the antenna, which is supported in the vertical plane.

Feeding The Antenna

A 300 ohm ribbon feedline is used, connected across the bottom center insulator. As the feedpoint impedance of the antenna is about 350 ohms, the SWR on the feedline is quite low, as is the line loss.

Since modern 6 meter equipment is designed for a 50 ohm feed, a simple antenna tuner is required at the station. I don't think you can buy one for 50 MHz, but it is easy to build one. Fig. 5 (taken from *The ARRL Handbook*, 41st ed., 1964, p. 452) is a suitable circuit. You can wind the coils yourself, but you'll have to go to the junk box for the variable capacitors. Capacitor C2 resonates the tuner and C1 controls loading. Start with low power and with C1 set at mid-scale. Tune C2 for better loading, and then vary C1 to obtain maximum load. Jockey the controls a bit for touch-up, and you're all set to go. An SWR meter between the tuner and the exciter is helpful.

My tuner was built breadboard-fashion on a small piece of 1/2 inch plywood, with a 3/16 inch Masonite panel. The original *Handbook* design used commercial coil stock, with L1 slipped inside the tuned coil, L2. The coils are supported by their leads, with L1 mounted directly to the tuning capacitor.

Using The Antenna

The antenna should be aimed broadside to the directions you wish to cover. The pattern is bidirectional and sharper than a dipole. Common sense tells you to get the antenna as high in the air as possible. I'd shoot for a height of at least 20 feet to the bottom wires. Since the array is less than 20 feet long, that should not pose a problem.

"Project Coldfeet"

In the late 1950s the U.S. military took note that the Soviet Union had been using drifting ice stations in the Arctic since 1937. This was no

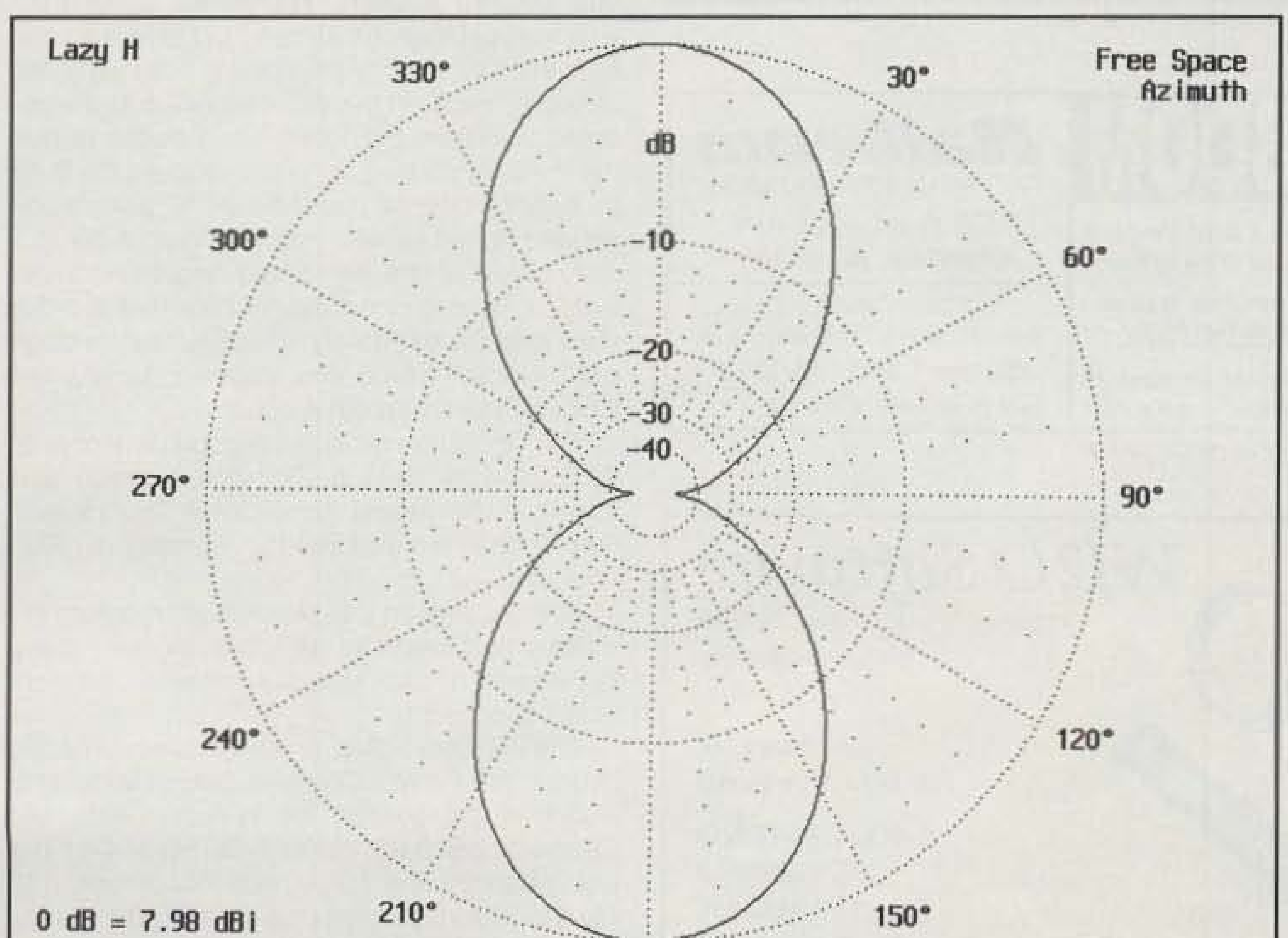

Fig. 4– Azimuth plot of the Lazy-H beam.

secret, but the U.S. was not particularly interested in the polar region, until it became apparent that missiles fired over the North Pole at the U.S. were a threat to national security. Suddenly, military interest in the northern polar area exploded, and various floating ice islands were investigated as a possible polar scientific site (see my column in the April issue, p. 52). It was also thought that an ice island could be a sonar listening post for atomic submarine operation in the polar sea.

What had the Russians been doing since their first drifting ice station (North Pole 1, or NP1) was activated in May 1937? A lot of data about the polar observations had been published by the Soviets in scientific journals. Now, in 1961, they were up to ice station NP10!

What was the purpose of the ice stations? A good guess could be made, but it would be advantageous to eyeball a Soviet station. How could this be accomplished?

In 1962 a hastily abandoned ice station, NP8, was spotted. The ice pack was deteriorating, and the Soviet personnel had been airlifted out. Would it be possible to land a team of American researchers on the crumbling ice island and get them out before the station disintegrated?

The Hazardous Trip To NP8

One of the key participants in "Project Coldfeet," as the daring operation was named, was Leonard LeSchack, ex-W2BFW, later W4RVN. LeSchack, a former Naval Intelligence operator, spoke Russian and participated in the planning and execution of Project Coldfeet.

LeSchack and James Smith, an Arctic Survival instructor and Russian linguist, were the members of the team.

On May 28, 1962 a USAF B-17 from Barrow, Alaska flew over NP8, and LeSchack and Smith parachuted down onto the ice island. A series of cargo drops followed. Smith erected a UHF radio beacon, and the two men set about establishing camp in the deserted Soviet buildings.

The next day LeSchack set up the radio equipment, borrowing the existing Soviet antennas. The arrangement was that NP8 and Barrow would monitor designated channels twice daily, but would not transmit unless there was something urgent to report.

After a few days LeSchack deemed it necessary to send a summary weather report to Barrow. The channel used was just outside the low end of the 20 meter amateur band, so LeSchack used his own call, W4RVN, to send a one-way message to Barrow.

By May 31 the investigation of the ice station was complete, and a package was made up of various logs and charts left behind by the hastily departed Soviets. The problem was how to get the investigators off the soft ice, which could not support the weight of a rescue plane.

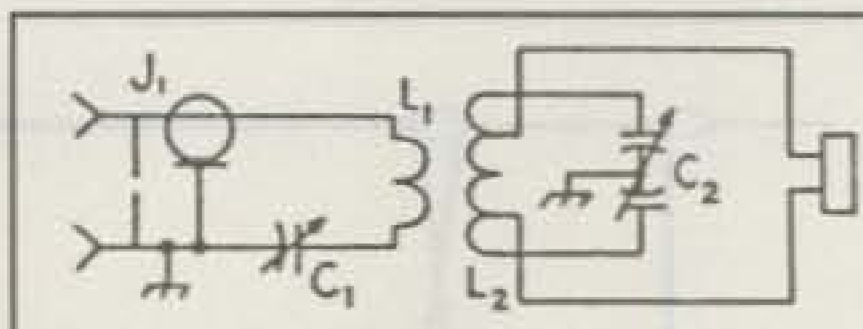

Fig. 17-30—Circuit and parts information for the v.h.f. antenna couplers.

C_1—100-μμf. variable for 50 Mc., 50-μμf. for 144 Mc. (Hammarlund MC-100 and Mc-50).

C_2—35-μμf. per-section split-stator variable, 0.07-inch spacing (Hammarlund MCD-35SX). Reduce to 4 stator and 4 rotor plates in each section in 144-Mc. coupler for easier tuning; see text.

J_1—Coaxial fitting, female.

J_2—Two-post terminal assembly (National FWH).

L_1—50 Mc.: 4 turns No. 18 tinned, 1-inch diameter, 1/8-inch spacing (Air-Dux No. 808T).

114 Mc.: 2 turns No. 14 enam., 1-inch diameter, 1/8-inch spacing. Slip over L_2 before mounting.

L_2—50 Mc.: 7 turns No. 14 tinned, 1-1/2-inch diameter, 1/4-inch spacing (Air-Dux No. 1204). Tap 1-1/2 turns from each end.

144 Mc.: 5 turns No. 12 tinned, 1/2 inch diameter, 7/8 inch long. Tap 1-1/2 turns from each end.

Fig. 5– Circuit of ARRL Handbook *antenna coupler for either 50 or 144 MHz.*

The Skyhook Pickup

After a few false starts, a B-17 finally reached NP8 on a clear day. It had a hair-raising rescue system aboard, known as "Skyhook," which would snatch the men aloft, one at a time, by means of a tether attached to a helium-filled balloon. In spite of the gathering wind and worsening weather, the information package and the investigators were hoisted aboard the B-17 as it made several passes over NP8—mission accomplished without injury or loss of life!

Analysis of the notes and photos retrieved from NP8 convinced the military that the Soviets had an extremely effective meteorological program which was superior to any the United States had developed.

The operation received a good deal of publicity, and in 1965 a Skyhook scheme was shown in the James Bond movie *Thunderball.* Rent it on video and see for yourself how Skyhook worked!

Today Leonard LeSchack is retired from the military and owns an oil exploration company in Canada. It is not known if he has an amateur ticket at present.

The full story of this amazing operation is told in the book *Project Coldfeet, Secret Mission to a Soviet Ice Station,* by William Leary and Leonard LeSchack (ISBN 1-55750-514-4). It is published by the Naval Institute Press, 118 Maryland Ave., Annapolis, MD 21402 (phone 800-233-8764).

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