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Compact and Portable Antennas Roundup
(Alpha Delta Outreach/Outpost; Bilal Isotron 40; Force 12 ZR-3; MFJ-1788; Traffie Hex Beam II)

Palomar Model AN7 (Antronic Multiwhip) HF/VHF Mobile Antenna

Product Review

*Edited by **Rick Lindquist, N1RL**• Senior Assistant Technical Editor*

Compact and Portable Antennas Roundup

By Rick Lindquist, N1RL, Senior Assistant Technical Editor, and
Steve Ford, WB8IMY, Managing Editor

One of the great things about VHF and UHF is that an H-T and its built in antenna will fit in your pocket, because these bands require hardly any antenna at all. Not so if you favor HF operating and still want performance. If you don't have room for a full-sized antenna—or are otherwise restricted in your ability to install one—a compact antenna might be just the ticket.

It's our experience that just about anything hooked to a transmitter will radiate RF. We've heard tales of stations working distances of several hundred miles while transmitting into dummy loads! For many hams, a handful of wire (with help from a tuner and a decent ground) can be pressed into service as a great "compact antenna" for HF that you can carry around in your back pocket.

We recently took a look at five comparatively compact antennas designed for various parts (in some cases multiple parts) of the HF spectrum. These ranged from a stocky little set of vertical dipoles to a portable set-up-anywhere vertical to a small loop to a lightweight single-bander with another worldly look, to a two-element beam you could easily pack along on your next trip or DXpedition. These antennas exhibited varying degrees of portability (not all were intended to be portable), but one might fit your particular HF application.

A *caveat:* As we say here at Headquarters, "RF gotta go somewhere." To field test these antennas, we set them up (sometimes in various locations) as we'd expect the typical ham would do. We evaluated performance the same way, by eliciting comparative reports from other stations. Therefore, it's important to keep in mind that our on-the-air results are anecdotal, *not* scientific. The performance we observed only represents our experiences under the given installation circumstances, ground characteristics, and prevailing propagation. We offer our observations only as a guide to what you might expect, but your results could vary.

A cautionary note: Some of these antennas are suitable for indoor installations. Hams should consider the RF exposure potential of indoor antennas. At close proximity to any antenna, it is possible to exceed the permitted exposure to RF energy, especially when using high power. For more information, see "FCC RF-Exposure Regulations—The Station Evaluation," (*QST*, Jan 1998) or visit **http://www.arrl .org/news/rfsafety**.

ALPHA DELTA OUTREACH/ OUTPOST SYSTEM

Here's a neat traveling ham's antenna that also could be just the thing for those situations where you might be otherwise restricted from installing a permanent antenna. Alpha Delta has teamed up with Outbacker to market this vertical antenna system that covers all bands 160 through 10 meters and can be set up just about anywhere—provided it's on the ground (this is not the choice for operating from a third-story apartment balcony

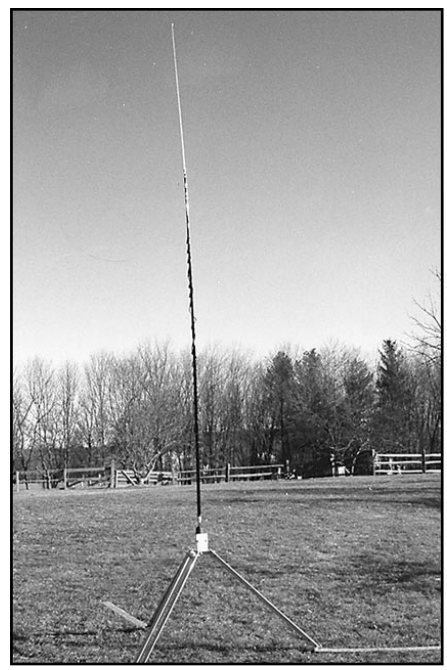


Table 1
Compact and Portable Antennas at a Glance

	Alpha Delta Outreach/Outpost	*Bilal Isotron 40*	*Force 12 ZR-3*	*MFJ-1788*	*Traffie Hex Beam II*
Band or frequency range of unit reviewed	160-10 meters	40 meters*	20, 15 and 10 meters	7.0 through 21.5 MHz (continuous tuning)	20 and 17 meters‡
Maximum power	150 W PEP	1000 W PEP/500 W CW†	3000 W PEP	150 W PEP	1500 W PEP
Antenna style	Helically wound, tapped vertical with tripod mount	Unique design; see text	Vertical comprised of nested parallel dipoles	Small loop with remote control head	Two-element single-band rotatable parasitic array
Manufacturer's suggested retail price	$599 for Outbacker and Alpha Delta mount	$70	$449	$360	$359 with one Band Pac; $29 for additional Band Pacs

*Other single-band units are available for 160 through 10 meters.
†500 W PEP/250 W CW for indoor installations.
‡Hex Beam II Band Pacs are available for 20 through 6 meters.

unless you don't mind running radials). The unit is rated at 150 W PEP.

The Alpha Delta system comes in two cartons. The larger one holds the Outpost mounting tripod, the smaller, triangular one holds the Australian-made Outbacker Outreach, a 12-foot version of the popular—and rugged—mobile antenna. The antenna breaks down into two four-foot pieces (the approximately four-foot-long "stinger" that tops it off stores inside the top section; in use, you extend it as necessary for resonance on a given band). The Outbacker Outreach packs away in a nice fabric carry bag, like a fishing pole. Assembling the Outbacker Outreach takes less than one minute. Outbacker has scored the stinger to indicate the approximate resonance point for the SSB portion of the bands it covers. The Outbacker Outreach is set up to operate on one band at a time. It uses a "wander lead" that wraps around the bottom of the antenna shaft that you plug into well-marked taps for the desired band.

The Outpost Tripod is made of heavy duty aluminum (with stainless-steel hardware) and is quite sturdy. You don't need any tools to set up; all fittings that need to be tightened are equipped with wing nuts. Just remove the packing tape and unfold the Outpost on the ground. At first glance, it's a bit ungainly, but once in place it's quite manageable (it reminded us a bit of the early lunar lander). Three flat pieces of aluminum stock flap down to couple to ground (Alpha Delta calls it "a large capacitor"). A mounting adapter fastens on the top of the Outpost, accommodating the antenna on the top side and a PL-259 for the feedline on the bottom side. Even taking time to unwrap the tape and to install the mounting adapter, we had this baby on the air in less than 15 minutes from unpacking.

Alpha Delta told us that because of the vagaries of ground conductivity, it's possible that the Alpha Delta Outreach/Outpost system will not resonate on the low ends of some bands. As noted, it's meant to tune primarily on the SSB portions. We found a problem getting a good SWR on the low end of 15 meters, and it would not tune much below 3800 kHz on 75 meters, even with the whip fully extended. We worked around those situations with the help of a tuner.

To get the unit on 80 meters, we also tried tightly wrapping the wander lead around the antenna shaft and adding a little capacity hat in the form of some wire affixed to the stinger. That helped some, and the tuner did the rest. Alpha Delta now offers a special 80-meter CW stinger for $12. The new Outreach 500 antenna covers 80 through 6 meters and includes band taps for 80 CW and 75 SSB.

Alpha Delta says it's possible to add radials to this system to get a good RF ground. We didn't find that to be necessary, even on 160 meters. Bandwidth was pretty restricted on the low bands, but this can vary from one installation to another depending on ground conductivity and other factors. For example, we were unable to achieve a 1:1 SWR on 40 meters, but it never rose above about 2.5:1 across the band either, suggesting a lossy situation. We'd typically expect the bandwidth to be fairly narrow, like a mobile antenna's.

On the air experience demonstrated that on 40 meters and above, this antenna system worked as well as to slightly better than a typical mobile antenna (we used the shorter Palomar AN-7, an Outbacker clone—see page 78—and a Comet CA-HV for comparison) mounted on a vehicle. We tested the Alpha Delta system over the typically poor ground of Northern Connecticut (mostly rocks). At times on 40 meters, depending on the path and conditions, reports indicated that the Alpha Delta compared pretty favorably to a Cushcraft R7000 vertical. One station in Michigan said the R7000 was just slightly better, while another in Tennessee said it was almost an S unit better. Another time, a Virginia op said the Alpha Delta unit was a tad better than the R7000, but still more than an S unit worse than a center-fed 80-meter dipole (fed with ladder line and using a tuner) at a modest height.

K4IX in Virginia, whom N1RL regularly QSOs on 40 meter CW from his mobile, said our signal while using the Outreach/Outpost system on that band was comparable to Rick's usual mobile signal. On 17 meters though, the Alpha Delta system sometimes outperformed the MFJ loop that we tested (see below) and the R7000 vertical, and rivaled the 80-meter centerfed. It did not hear quite as well as those antennas for some DX paths, however. The SWR across 17 meters never rose above 1.7:1. On 15 meters, the system's bandwidth was approximately 200 kHz, but, again, this could indicate a lossy situation.

We compared the Force 12 ZR-3 (see below) and the Alpha Delta Outreach/Outpost on 15 meters. On receive, a station in Brazil was approximately equally strong on either antenna system. Our report from him was the same, regardless of antenna. On 20 meters, the ZR-3 had the receiving edge, but on transmit, both antennas performed about the same, judging from reports. We worked JA1NUT on 20 meter CW, and Shin was patient enough to endure considerable antenna switching during our QSO. Signals on both ends showed evidence of polar flutter. He was running 500 W to a 4-element Yagi. We were running 100 W. The bottom line was that he was unable to detect any difference between the Alpha Delta system and the ZR-3 over the course of our 10-minute QSO.

We just had to see if the Outreach/Outpost system actually would work on 160 meters. While we couldn't get a perfect SWR, it was less than 2:1 (probably not the fault of the antenna as much as of the Connecticut soil). The usable bandwidth was less than 20 kHz. On receive, W1AW (20 miles away) was S7 with the Alpha Delta system and S9+20 dB on a halfwave dipole. OK, so can anyone hear it? Running 100 W from Northern Connecticut yielded S7 reports from stations in New Jersey, New Hampshire and the Connecticut Shoreline. But, with a halfwave dipole in line, our reports jumped to well over S9. "Night and day" was how one of the stations described the contrast between the two antennas.

The Outbacker Outreach by itself was pressed into service at the FP/N1RL and FP/W8MV operation from Miquelon Island the weekend of the ARRL 160-Meter Contest last December. Aided by 20 or so radials of up to 30 feet, it performed nicely on 40 through 15 meters, but also snagged a few stations on 160 meters. So, it *will* get out on 160, and it's likely that adding some longer radials improve performance (we didn't experiment with this).

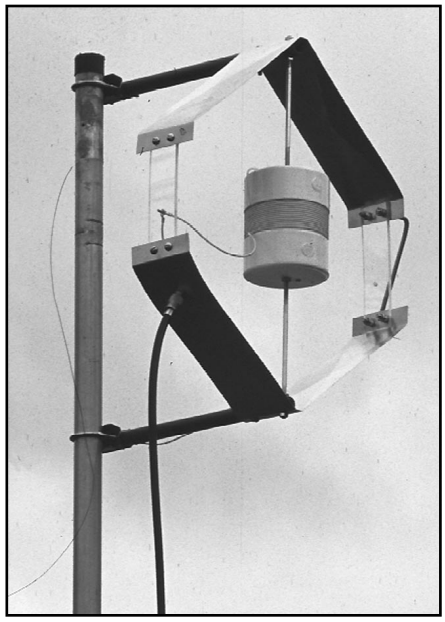
Our experience was similar on 80 meter CW when using the complete Outreach/Outpost system. During a period of fairly noisy conditions, we found it was impossible to break through to some stations during a normal schedule on that band, while a fullwave dipole was solid copy. On receive, a station almost 100 miles away in Vermont was S5 with the Alpha Delta system, but S9+20 on the fullwave dipole. On transmit, the Vermont station said our signal dropped into the noise with the Alpha Delta.

The biggest pluses of the Alpha Delta Outreach/Outpost system are its portability and its extensive band coverage. The whole package weighs around 22 pounds. Field Day planners and DXpeditioners might want to check out this system. It's a decent performer, sometimes surprisingly good, on the higher bands where its small size is less of an issue. Going by what we found, you can expect performance equal to or slightly better than a typical mobile system, depending on the band you're on and the ground conductivity. The Outreach/Outpost system will put out a signal on 160 and 80, but not necessarily much of one. These advantages don't come cheaply; the full package will set you back almost $600, and the Outbacker Outreach amounts to two-thirds of that cost. The Outpost tripod may be used with other Outbacker products or with mobile type antennas from other manufacturers, however, and you can purchase the tripod separately.

Manufacturer: Alpha Delta Communications Inc, Box 620, Manchester, KY 40962; tel 606-598-2029; fax 606-598-4413. Manufacturer's suggested retail price: Outbacker Outreach antenna, $399; Outreach 500 antenna (80 through 6 meters, 500 W), $439; Alpha Delta Outpost Tripod, $200.

BILAL ISOTRON 40

Isotron antennas are compact single-band units available for all HF bands, including 160 meters. The 160 through 30-meter Isotron units look for all the world like those bird feeders with the tube full of seed in the middle. Except instead of a tube full of seed there's a coil suspended between the two metal plates. We ordered the 40-meter version. A few days later, a very small, lightweight box arrived. Could this be right? Yes, indeed! It was all in there—some assembly required, of course. It took maybe 30 minutes to assemble. Although you can almost figure out the assembly from the pictures and without the instructions, an additional illustration or two would have been helpful. The finished antenna is quite small. It's approximately 21 inches tall and maybe 18 inches across. This is essentially a tuned circuit that you stick up in the air. Bilal says the polarization is "random" and that the antenna can be mounted in any position. The manufac-



turer has fixtures available to mount several Isotrons coupled to a single feedline.

Except for the mast clamps, the hardware is stainless steel. We were concerned about the lack of lock washers or other means to ensure that the hardware does not loosen over time with vibration and temperature changes.

The coil is wound of solid, insulated 14-gauge wire on a PVC form. The two supports are PVC pipe. The top and bottom V sections are tempered aluminum. Plexi-glass supports tie the top and bottom pieces together. Two rods secure the coil in place, top and bottom. An adjustable "tuning rod" extends out and downward from the top cap. The whole assembly is very lightweight and, we thought, durable. However, during testing, one of the aluminum coil mounts—a piece of 1/4-inch stock threaded on the ends—broke while we were moving the antenna from one location to another. We had to order another piece from Bilal.

We first mounted the Isotron 40 on a 20-foot mast and grounded the mast, as the manufacturer suggests. It had a pretty good bandwidth—in the vicinity of 90 to 100 kHz. As already noted, that's not necessarily a good sign. A wide bandwidth on an antenna this small suggests a lossy system. We used the Comet CA-HV and Palomar AN-7 mobile antennas—both mounted on a vehicle—for a comparison. The antennas heard and were heard identically well by the stations we worked. Using the Isotron 40, we easily contacted several stations in the Tennessee QSO Party that same weekend.

We also tested the Isotron 40 on a fairly short outdoor mast without a ground, and got a decent 1.5:1 SWR. We made several SSB contacts, switching back and forth between a 40-meter dipole at around 40 feet and the Isotron, at that point, maybe eight feet off the ground, admittedly a lopsided comparison. As expected, the dipole outperformed the Isotron, but the difference was not that huge (maybe a couple of S units) when you take into account the Isotron 40's size and height.

Bilal says the Isotron performs best while high and in the clear. And so it did. At 35 feet up, it outperformed the Comet CA-HV mobile antenna on some, but not all, paths. For example, we had trouble hearing T95A with the mobile antenna, but we snagged him on our first call (at 100 W) while using the Isotron. But, on that evening at least, the CA-HV turned out to be the slightly better antenna for some stateside paths.

The Isotron appears to be an ideal antenna for an attic installation, although manufacturer Ralph Bilal, WDØEJA, says he has never advocated indoor installations. However, the manual suggests it needs to be grounded, something that's difficult to impossible to achieve in your average attic. For a variety of reasons—most having to do with safety and good engineering practice—we were reluctant to "ground" it to the power system neutral as the Isotron manual suggests for indoor installations like this. (Bilal maintains that grounding to the electrical ground is "the proper and electrical safe thing to do.")

Instead, we tried mounting the Isotron on an eight-foot mast and connecting a feedline, but no ground. In that configuration, the antenna resonated somewhere well below the CW band, even with the tuning rod adjustment all the way up. Adding approximately 1/4-wavelength of wire to the bottom of the mast and removing the tuning rod altogether got us into the phone band with a decent SWR.

Comparing the attic-mounted Isotron 40 and the R7000 on receive, we found the R7000 was, by far, the winner. One North Carolina station discerned "a few dB" difference between the R7000 and the Isotron 40. In other cases, switching from the R7000 to the Isotron 40 caused our signal to be lost altogether. Some signal reports suggested that the Alpha Delta Outreach Outpost system in the yard was slightly better (maybe an S unit) at times than the Isotron 40 in the attic, but other stations couldn't tell much difference. The main problem was that having the antenna in the house caused it to more readily pick up various manmade noise, like computer hash (and it more effectively put RFI into the telephone lines). These problems were not restricted to this particular antenna, however.

Installing the Isotron 35 feet in the air outdoors (several feet higher than it was in the attic) improved its odds against the R7000, with a few reports indicating it was a dead heat or slightly better. But over time, more reports suggested the R7000 was the superior performer, over both stateside and DX paths.

While mobiling one evening, we happened to run into a station in Florida that was using an Isotron. He said it was great for working stateside stations, but he had not had much luck working DX with it.

Bilal rates the Isotron 40 at 1000 W PEP or 500 W CW into the antenna when it's mounted out of doors. For inside applications, the manufacturer cuts those figures in half.

Overall, this is an inexpensive, lightweight, and highly portable antenna (the smallest of our current lot) that might find use during Field Day or in those situations where there just isn't room for a larger antenna. Our experience suggests that, for typical indoor or modest-height installations, you can expect performance comparable with that of a mobile system, and occasionally better.

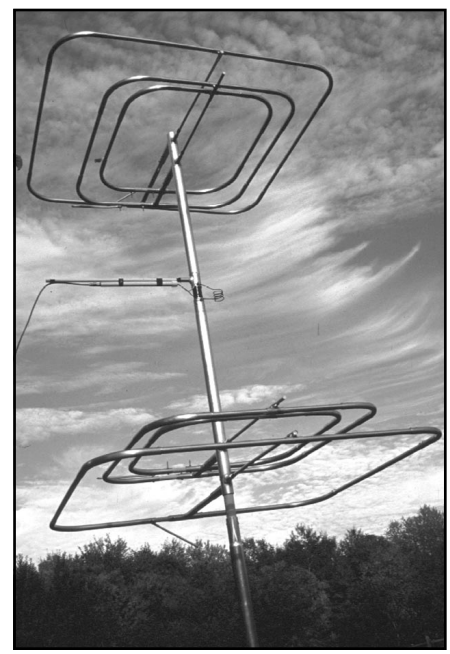
Manufacturer: Bilal Company, 137 Manchester Dr, Florissant, CO 80816; tel 719-687-0650. Manufacturer's suggested retail price: Isotron 40, $70; 80-40 meter combination system, $134.50; 10, 15, 20-meter combination, $145.

FORCE 12 ZR-3 MULTIBAND VERTICAL

Force 12 describes its model ZR-3 as a vertical, but it almost defies categorization. Let's just say that this three-band affair (20, 15, and 10 meters) definitely is not your traditional vertical. The ZR-3 stands just about six feet tall, and, at 24 pounds, is light enough to be easy to handle. With a footprint of about four square feet, it's somewhat larger and bulkier than other "portable" antennas such as miniature loops, but it still will fit into attics, garages, on balconies or rooftops, or anywhere else you have the space. Force 12 says the design goal was to have an antenna that's efficient but can be mounted "at fence level." Based on our experience, the manufacturer met that goal.

The ZR-3 is great for outdoor use in areas where it is impossible or impractical to erect a full-sized dipole or tall vertical. With its bright aluminum loops, the ZR-3 isn't very "stealthy," but you can paint it for camouflage, or simply hide it behind the shrubbery. The ZR-3 is fairly easy to set up and tear down (an electric screwdriver sure speeds things up), making it ideal for Field Day or any other expeditions you may have in mind. You could even transport it fully assembled in the back of a pickup truck.

One of the strongest points of the ZR-3 is the fact that it is actually a set of *full-sized*



center-fed vertical dipoles for 20, 15 and 10 meters. There are no traps, loading coils, toroids or radials. When it's assembled, you might mistake it for a piece of playground equipment or modern sculpture. If you straightened out all the bends and curves, though, what you'd have would be three full-sized, halfwave dipoles in parallel fed in the middle via a ferrite balun. What appear to be nested loops are really just continuations of the dipole legs. Visualize a three-band, 1/2-wavelength parallel dipole standing on end with portions of its legs bent into squares and you'll have the picture.

The ZR-3 is designed to mount just a few feet above ground. The manual even suggests mounting the antenna in a five-gallon bucket filled with concrete! When it's ground-mounted, Force 12 says, the ZR-3 produces a donut-shaped radiation pattern with a take-off angle between 14° and 22°.

The ZR-3 arrives in a large, imposing box stuffed with aluminum tubing and an incredible amount of packing paper. We had trouble getting the carton into the back seat of a subcompact sedan. As you remove the parts it's easy to think that you've bitten off a little more than you'd care to chew. After several minutes of digging, you end up with a bewildering assortment of pipes, a manual, and a plastic bag filled with hardware and other components. Fortunately, the 15 and 10-meter elements are put together at the factory, and assembly is *much* easier than it looks!

You'll need a Phillips-head screwdriver and a pair of pliers. Patience is important because you must follow the directions to the letter. The tubing sections must fit together in the correct manner or the antenna will not work properly. The manual is well written, with drawings and photographs to assist you. In addition, the individual pieces of tubing are clearly labeled. The instructions were first-rate, and the manufacturer includes some anti-oxidation compound and an application brush. For the most part, this is a pretty rugged piece of work.

Several self-tapping screws hold each loop section onto the upper and lower radiators. Four white fiberglass rods keep the loop sections properly separated and aligned (our ZR-3 arrived without the fiberglass rods, but a quick call to Force 12 was all it took to get another set on the way). The upper and lower sections of the ZR-3 are separated by a center insulator. A multiturn "hairpin match" coil bridges the sections. This is also the feed point where you connect the 1:1 balun.

We lifted the ZR-3—which was easy to do since the center of the antenna is also its center of gravity—and dropped it into a rooftop tripod mount that we had on hand. We thumbed the **STOP** button on the stopwatch: 90 minutes exactly.

The ZR-3 has two adjustments. First, you adjust the hairpin matching coil that's common to all three bands. As the manual instructed, we began on 20 meters with the rig set on 14.200 MHz. It only took a little tweaking to arrive at a 1.8:1 SWR. Little aluminum "tuning spikes" attached to the ends of the upper and lower elements set the tuning range. By moving the 20-meter tuning spikes, we were able to achieve a 1:1 SWR in short order. According to test results, the ZR-3 provided at least 200-kHz 2:1 SWR bandwidth on 20 meters. Force 12 says 20-meter bandwidths of up to 300 kHz are typical, but objects such as shrubbery or other metal in the vicinity can affect this.

The 15 and 10-meter loops are nested inside each other with one tuning spike for each upper and lower section. We quickly achieved a 1.3:1 SWR at 21.300 MHz by simply adjusting the tuning spikes. We did not need to adjust the hairpin coil. The 2:1 bandwidth on 15 meters appeared to be about 300 kHz. Getting a match on 10 meters was tricky. We tried to resonate the ZR-3 on 28.400 MHz, but in doing so the SWR on 15 meters drastically changed. The only way we could achieve resonance on 10 meters without affecting the 15-meter section was to resonate at 28.100 MHz. After about 30 minutes worth of fiddling, we were finally able to achieve acceptable SWRs on the phone portions of all three bands.

With the ZR-3 at the end of the driveway (and drawing puzzled stares from neighbors) we went on the air. On a virtually dead 10 meter band, we managed to scare up a contact with a fellow in South Carolina who gave an S6 report (he was just S3). On 15 meters, we were rewarded with an S9+ from the Virgin Islands. On 20 meters, we made it through several DX pileups. During the week that followed, we received more glowing reports on all bands.

We compared the ZR-3 with the R7000 vertical. On 20 meters, they seemed to hear about the same, although the ZR-3 had a narrow edge on stateside signals. It was pretty close. The DX reports we got also were too close to call. Local reports were the same on both antennas. On 15 meters, the ZR-3 seemed to hear and be heard slightly better on European paths. On 10 meters, the ZR-3 heard much better than the R7000. We also compared the ZR-3 with a 20-meter dipole at 30 feet. The ZR-3 performed as well or better every time! On the three bands and over many paths, the ZR-3 also compared nicely in performance with the 80-meter dipole.

Overall, the ZR-3 performed very well—especially when you consider that it stands just a yard above *terra firma*. If we had one complaint about the ZR-3 it was that the self-threading hardware tended to loosen up over time (we had the antenna outdoors for several weeks). Attempts to tighten these screws usually resulted in stripping the "thread." A better means of securing these element joints seems to be in order.

The ZR-3 has a 3000 W PEP rating (Force 12 says the design is patterned on a commercial antenna design). Keep in mind that such an antenna presents high RF voltages at the element "ends," and it should be mounted out of the reach of humans and pets.

The ZR-3 will put a hefty load on any ham's budget. On the other hand, it may be the answer if you seek an efficient, low-profile HF antenna. If you lack the space for a full-sized antenna for 20, 15, and 10, the ZR-3 offers a possible solution. Based on our observations, you can expect performance comparable to many other "full-sized" antennas.

Manufacturer: Force 12 Inc, PO Box 1349, Paso Robles, CA 93447; tel 805-227-1680; 800-248-1985; fax 805-227-1684; **http://www.QTH.com/force12**. Manufacturer's suggested retail price: $449.

MFJ MODEL 1788 SUPER HI-Q LOOP

Back in 1994, we looked at the MFJ Model 1786 High-Q Loop Antenna for 10 to 30 MHz (see "Product Review," *QST*, Aug 1994, p 62). Several months ago, MFJ came out with another version, the MFJ-1788, that covers 40 through 15 meters instead. The loop antenna itself and the control box that goes with it look the same, and you operate them in the same manner. The big difference is the addition of 40 meters. The thought of being able to work 40 through 15 meters (inclusive) with an antenna just three feet across was intriguing.

Our earlier review pretty well covered the basics. To recap briefly, the MFJ-1788 loop is manufactured from a single piece of rugged 1.25-inch aluminum tubing, with the joints welded to minimize losses. It's 36 inches in diameter. A two-piece plastic cover spans the diameter of the loop and contains the control motor, tuning capacitor, and associated electronics, plus a coupling link that transfers the feedline to the loop.

The remote control box for the MFJ-1788 loop has seven pushbuttons, four LEDs and a cross-needle SWR/power meter. A plug-in wall cube powers the unit, but you also can run it from batteries you install inside the box. DC to operate the motor in the loop assembly is carried via the feedline, so you don't need a separate control cable. You just connect a coaxial cable between the remote control box and the loop. That's very convenient and enhances portability and installation ease. However, it also complicates somewhat how you connect antenna feedlines for, say, lightning protection. You can't short the outgoing feedline or you'll short

the power supply as well (RF is coupled via capacitors). This antenna can be mounted horizontally or vertically. MFJ provides mounting hardware.

The idea is that you apply a teeny bit of RF to the system on one of the bands it covers, then press either the **UP** or **DOWN AUTO BAND SELECT** buttons on the box. Unless it's at the end of its range, the LED will light, and the motor in the loop will drive the capacitor in the appropriate direction. When the unit passes the resonant point, it will stop turning the capacitor and emit a high-pitched beep. Then, you release the **UP** or **DOWN** button and press the **FINE TUNE** button that's next to the **SLOW TUNE** LED that's lighted, watching the SWR meter the whole time. Soon, you'll notice a very sharp dip as the system comes into (and almost as quickly leaves) the point of resonance. You'll get adept at jabbing or poking both buttons to get a minimum reading. That's it. Then, you can operate. If you're loathe to be classified as a tuner-upper, you can also tune up (or get real close) using maximum band noise, but it's trickier and slower. Once it's at resonance, you can apply up to 150 W to the antenna system.

The *Instruction Manual* is quite easy to follow, but we simply could not get our first unit to work at all. Finally, we removed the two dozen or so self-threading screws from the plastic shells and discovered the rotor plates on the variable capacitor wobbling about freely. We were unable to tighten up anything to make it work. A call to MFJ brought another loop to our door that MFJ had checked out thoroughly beforehand. We repeated the experience of the first loop. Its capacitor assembly also was loose, with so much play that the capacitor's plates touched.

A call to one of MFJ's engineers finally solved the mystery. Apparently, these units were being damaged in shipping because the packaging was insufficient to protect them if the box was dropped on its end. The damage was in the motor itself, which serves as one of the rotor shaft supports. MFJ sent just a new motor assembly. We installed it, adjusted the stop points for maximum and minimum, and the unit tuned as described. We're not sure at this point if MFJ has changed the way it packages these antennas for shipping, however.

Compared to a full-size antenna on any of the bands it covers, this is a *really* small antenna. Keeping ohmic losses to a minimum is critical, so the entire unit is welded together; even the capacitor is welded to the loop ends. It also makes for very sharp tuning and a narrow bandwidth—which can have its advantages on receiving. On 40 meters, once you're tuned up, you can't move more than about 5 kHz before you have to tune again (ie, SWR rises above 2:1). We found that when you're moving "up" the band, you had to press the **DOWN** button to get back into resonance. The bandwidth was slightly broader on the higher bands. We measured approximately 35 kHz of bandwidth on 17 meters and nearly 60 kHz on 15 meters.

Because it's so small, this should be an ideal attic antenna, so we mounted it in the garret to see (MFJ says it can be mounted indoors with some degradation in performance). For some reason, we discovered that we were able to get much closer to a 1:1 SWR with the unit mounted vertically (literally hanging from the rafters) than with it horizontally, but we tried it both ways. Since this antenna's tuning range is continuous, it should make a handy SWL antenna.

The MFJ Model 1788 loop heard pretty well on 20, 17 and 15 meters. On 17 meters, it heard better by an S unit or two than the R7000 vertical. It also heard some stations as well as the Traffie Hex Beam II (see below), but it was considerably less effective on receive than the 80-meter center fed dipole. Stations in Florida and Virginia were almost as strong on the loop as when using the R7000. During the November Sweepstakes SSB weekend, it was sometimes a challenge to make ourselves heard over the madding crowd on any band while running 100 W, but we were able to work many stations on the first shout, especially on 15 meters. Of course, operating in search-and-pounce mode necessitated many tuneups and touch-ups along the way. It was also very easy to inadvertently hit the fast-tune buttons instead of the fine tune buttons, which meant having to start all over again on the tuning sequence.

On 40 meters, the MFJ-1788 loop just did not cut the mustard compared to most other antennas. Transmit comparison tests on 40 meters among the R7000 and the 80-meter dipole and the MFJ loop were clearly in favor of the R7000 and the dipole on East Coast paths. Stations in Maryland, Virginia and North Carolina reported the trap vertical topped the MFJ loop by anywhere from one S unit to nearly 20 dB. The difference between the dipole and the loop was even more dramatic, "a huge difference," as one station put it. While we were S8 to S9 on the dipole, switching to the loop put us into the noise. The other thing we noticed pretty consistently was that fading increased noticeably when using the loop as compared to the other antennas.

Even compared to the Outpost/Outreach system over relatively poor ground, the MFJ loop—much higher but in an attic—was an S unit or two worse on 40. As K4IX in Virginia put it, there was "a very clear difference" between the Alpha Delta system and the MFJ loop on 40 meters. As the band changed, however, the distinction became a little less clear over that particular path, and the MFJ was neck-and-neck with the Outbacker/Outpost system and a bit better than the R7000 at times. At one point, W8MZV in Ohio was hearing the Alpha Delta system and the MFJ loop equally well.

Looking farther out, however, it was a different story altogether. K6XK in Iowa at one point could barely copy us on the loop. A bit later, though, he indicated that it was only an S unit or so worse than the Alpha Delta system. Overall the loop, when horizontal, seemed quieter on receive on 40 meters than any of the vertical antennas, perhaps because it also is a tuned circuit that effectively attenuates energy outside its narrow passband. But it never heard as well as the other antennas on 40 meters either. The typical difference on receive was an S unit or more compared to the Alpha Delta system and much more when compared to the R7000 or an 80-meter centerfed.

It was a different story on the higher bands. For example, initially, OH1SR gave equivalent reports on the R7000 and the MFJ loop on 17 meters, while indicating the Alpha Delta system and the 80-meter dipole were about the same—both approximately an S unit stronger on that path. From a receiving standpoint, though, the loop heard the Finnish station better than any of the other antennas, and as the band changed, a second test put the loop in the lead over the Outreach/Outpost system by an S unit or so. On the other hand, 9H1AL was able to hear the 80-meter centerfed just fine but had problems copying us with the Alpha Delta system or the loop, even though he was stronger on the loop by an S unit.

Overall, this little antenna does offer a lot of convenience—especially for someone who needs to keep a low Amateur Radio profile. The trade-off is (what else?) in performance, and especially on 40 meters. Based on our experience, you can expect mobile antenna performance on 40 and 30. On the higher bands, it often (but not always) compared favorably with larger antennas, including the R7000 vertical. It certainly should not be too hard to find a place to mount this antenna, indoors or out, but if you're contemplating one for the attic and you've got one of those hatch-in-the-ceiling entries, you might need to measure first to be sure it will fit through. This antenna also could come in handy for Field Day.

Manufacturer: MFJ Enterprises, Box 494, Mississippi State, MS 39762; tel 601-323-5869; fax 601-323-6551; e-mail **mfj@mfjenterprises.com**. Manufacturer's suggested retail price, $360.

TRAFFIE HEX BEAM II PORTABLE ARRAY

Whoever it was that said good things come in small packages could have been talking about the Hex Beam II Portable Array. Of course, it expands into a pretty good sized antenna once you put it together, but it disassembles into a very compact package. The Hex Beam II is basically a two-element parasitic wire array supported on six fiberglass poles that radiate from a central hub (the wire elements look like two Ws arranged top-to-top), so the whole thing looks a bit like a spider on its back, hexagonal in shape.

The Hex Beam II antenna is extremely lightweight (under 8 pounds for the 20-meter version), so it's easy to handle. The

20-meter version has a turning radius of 9½ feet. Taken apart, the whole antenna fits into a very small, zippered nylon tote bag (optional) that looks like it might contain fishing gear or a small rifle that you can carry over your shoulder.

Mike Traffie, N1HXA, and the Traffie Technology crew build the Hex Beam and can package the antenna with a customized Portaple, a telescoping 30-foot support pole manufactured by New Wave. We got the Portaple to ease testing. The Hex Beam is designed to snap right onto the top section.

Manufacturing the Hex Beam appears to be fairly labor-intensive. Many of the smaller parts look as though they have been fabricated individually (ie, not mass-produced). There are lots of color-coded pole sections you fit together to support the two elements. You use all of them for the 20-meter array and subsequently fewer as you move to the shorter wavelength bands. This is why it's a good idea to have the tote bag, which contains pockets for each "color" as well as for the coils of wire for the elements and other miscellaneous pieces necessary to assemble the Hex Beam. Individual *Band-Pacs*—the actual wire elements with fittings—are available for 20 through 6 meters. We got the ones for 20 meters (CW and SSB) and 17 meters. The half-wave elements of hard-drawn, bare stranded #14 copper wire. Elements attach to the center support via threaded fittings. Thoughtfully, the manufacturer engraved these fittings with the band segment (eg, 20 CW), so there's no mistaking which ones you're attaching.

At first, all the pieces were a bit intimidating, but with the instruction sheet in hand, we were able to assemble the Hex Beam II (set up for 20 meters initially) in about one hour—including some head scratching. Once you're familiar with the routine, though, this should go much more quickly.

Traffie recommends securing the hub section on a spike or post in the ground to facilitate assembly. We used a convenient snow bank instead. Contrasted against the white background, it was a bit easier to see the poles and wires than in Traffie's "green grass" color photos in the instruction sheet.

One caution is to be careful when unfurling the pieces of 300-pound-test Spectra line used to help tether the sections. They can easily become tangled. You need but few tools to assemble the Hex Beam II—just a small Phillips head screwdriver, a 5/16 (or a small adjustable) wrench, and a tape measure. The antenna feeds directly with coax. There's an SO-239 fitting right on the center support/hub section.

We only encountered a few problems during assembly. While Traffie's instructions (including handwritten additions) were generally clear, the manufacturer should consider adding a page to identify the pieces (perhaps with illustrations) so the user knows precisely which ones the instructions refer to. We were able to figure it out with the many photographs, however. Also, we found that the ends of the wire elements would not quite fit through the holes drilled in the tip fittings that hold them in place at the ends of the fiberglass poles. We reamed these out ever so slightly with a larger drill bit, and things proceeded smoothly. The manufacturer says it's corrected this problem, which resulted from a move to thicker-walled heat-shrinkable tubing on the element end fittings.

With the coax attached and taped to the center support, we set the assembled Hex Beam II on the Portaple which we'd mounted on a rotator. This arrangement did not allow us to fully extend the telescoping pole (guying was not practical in this particular installation, in part because of the snow cover and the frozen ground), but we did get it approximately 24 feet into the air—a modest height for a 20-meter array to be sure.

With the better part of 100 feet of feedline attached, we found the SWR in the shack to be pretty minimal (ie, less than1.5:1) across the entire 20-meter band. Our element set was cut for the CW band, where the antenna exhibits optimal front-to-back ratio and gain. Traffie says the beam will remain fairly flat and have good gain across the entire band, but the f/b ratio will drop off once you stray outside the design segment. On-the-air testing confirmed this.

We also were able to quickly and easily confirm that the antenna was working. Starting with the array facing away from the house then aiming it toward the shack brought up our little field strength meter from practically nil to half scale or so. By the way, the Hex Beam II is rated at full legal limit.

Working into the Midwest, the beam yielded signal some reports comparable to an 80-meter center fed dipole (which might exhibit some gain on that band), but better than the R7000 vertical. The antenna exhibited very good rejection off the sides and rear—perhaps as important a reason as gain to use a beam. A Finnish station, S7 with the beam pointed its way, went into the noise off the back side of the array. One very loud US station went from 20 dB over S9 to S9 or so when we swung the beam in the opposite direction.

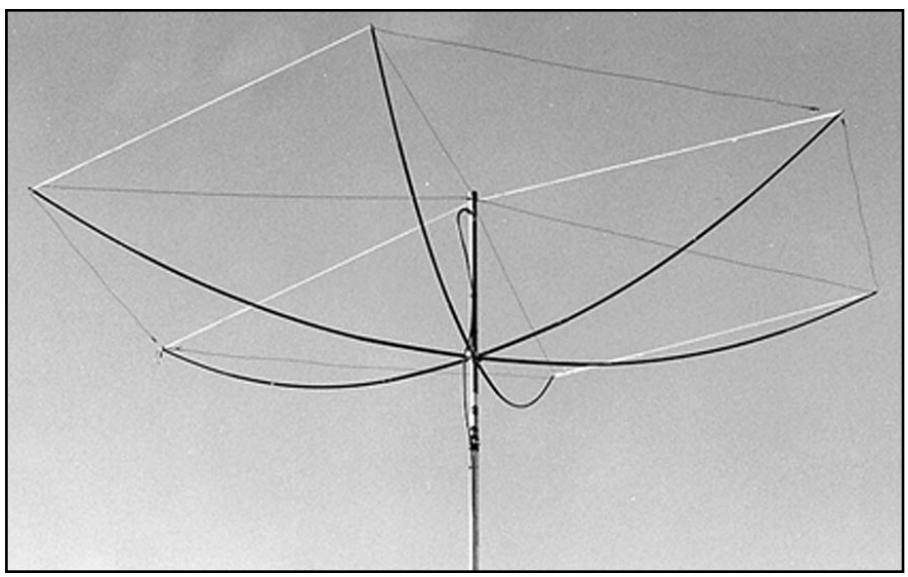
Aiming elsewhere, we copied a station in Ivory Coast whose signal was noticeably stronger on the beam and much better—maybe by an S unit or so—than on the R7000 vertical. Another station in Gabon was louder on the dipole, however. A Russian station was more readable on the beam, in part because the beam rejected some noise off its side that the dipole could not discriminate against.

We also used the array to work several stations in the ARRL RTTY Roundup. We got solid reports, and it performed nicely. Overall, we were able to hear the signals we wanted and often to eliminate unwanted noise or QRM off the back or sides.

We also set up the antenna for 17 meters. This involved removing some of the fiberglass tubing sections and stowing them in the nylon tote bag, then removing the 20-meter elements (it's best to roll up the wire; it requires some care) and attaching the 17-meter set. This went smoothly until we got to the point where we were attaching the end of the last wire into the little round, plastic end insulator. Each of these insulators has been drilled and a brass fitting (to secure the tip of each element) has been inserted and expoxied in place. The brass fitting is nearly the same diameter as the plastic insulator. Apparently during drilling, the plastic can crack, and one of these end insulators broke apart as we were tightening up the screw. The solution appears to be to use a larger diameter plastic rod. Inspection of the other end insulators indicated stress cracks, suggesting that they might also be in danger of breaking. We worked around this problem by securing the element with a piece of nylon cord.

Traffie promptly replaced the broken end insulators and says it's taking our suggestion to employ a larger diameter plastic rod stock in the future.

On 17 meters, even though we'd carefully measured the critical distances according to the instructions, the antenna appeared to be resonant around 18.4 MHz, so the SWR was a bit higher (typically 1.8:1 or lower) across the band. Traffie says certain feedline lengths can affect the SWR slightly. Rejection off



the back typically was between 10 and 20 dB for stateside signals; rejection off the side was even more dramatic, depending on the path. One stateside station went from S5 to noise level with the beam turned 90° away from his direction.

In a side-by-side receiving test, the Hex Beam handily outperformed the 80-meter center fed, the R7000 vertical and the MFJ loop. Overall on 17, the Hex Beam was much better than the R7000—often by a couple of S units or more on receive—depending on the path involved. Thanks to the Hex Beam, we were able to get through some pretty fierce QRM. Other stations indicated it was doing a great job compared to the alternatives at hand.

By the way, Mike Traffie says astronaut Chuck Brady, N4BQW, used a Hex Beam II during his South Pacific DXpedition last year.

At an even greater height, this antenna certainly would perform even better (especially on 20 meters), but it acquitted itself quite well for two elements at less than a halfwave above the ground over both DX and stateside paths. Judging by our experience, you can at least expect typical small beam performance, depending on mounting height. While designed primarily for temporary or portable use, the Hex Beam II can be installed permanently. Its feather weight and low wind-loading profile mean you don't need much of a rotator to turn it. For portable applications, it will turn very easily by hand.

Manufacturer: Traffie Technology, 421 Jones Hill Rd, Ashby, MA 01431-1801; tel/fax 978-386-7900; toll-free 888-599-2326 (BEAM). Hex Beam II Portable Array (with one Band-Pac), $359; additional Band-Pacs, $29; array with all 6 Band-Pacs, $479; custom nylon tote bag, $79; Portaple (manufactured by New Wave Antenna, 3320 S Knox Ct, Englewood, CO 80110; tel 303-761-1458), $190.

Palomar Model AN-7 (Antronic Multiwhip) HF/VHF Mobile Antenna

Reviewed by Steve Ford, WB8IMY
Managing Editor

Antenna manufacturers are coming around to the new reality of HF mobile operating. That is, many amateurs now own rigs capable of 6-meter, and in some cases, even 2-meter operation in addition to the traditional 80-10 meter coverage. While at least one other multiband HF mobile antenna now features 6-meters, the Palomar Model AN-7 (manufactured as the Antronic Multiwhip and distributed by Palomar) is among the first to offer *2 meters* as well.

Construction

The Multiwhip is manufactured in Pinetown, South Africa (quite possibly the only mobile antenna to be made there) and bears a physical resemblance to the popular Australian-made Outbacker. The AN-7/Multiwhip is composed of handwound copper wire on an inversely tapered Fiberglas core. A spring is attached at the top of the helix to support the adjustable stainless-steel whip. When you see how big the Multiwhip is, you can understand why they used this approach. The green-colored core section is four feet tall and weighs in at just under two pounds. Add the whip and you have a total length exceeding 7 feet. Because it is likely to strike low tree branches and other objects, the spring allows the whip to bend almost 90°. The Multiwhip has a sturdy base section with a standard 3/8-24 threaded stud.

Coiling around the core section like a thin, black snake is the *wander lead*. The wander lead has banana plugs at both ends. To change bands you simply move the top plug from one band socket to another. The Multiwhip offers coverage on 80, 40, 20, 15, 10, 6 and 2 meters, but only five band sockets are available. (Twenty and 6-meters are combined on one socket, and 15 and 2 meters on another.) There are no apparent provisions for operating on 30, 17, or 12 meters, which also are popular bands for mobile and portable ops.

Installation

Achieving seven-band coverage on a single mobile antenna is a neat trick, so I was more than curious to see how the Multiwhip would perform. Antronic includes stainless-steel whips in two lengths: 49 and 54 inches. They also throw in two wander leads, one somewhat longer than the other. As you read the instructions, it soon becomes evident that obtaining acceptable SWRs on all bands is a matter of juggling variables. The length of the wander lead and the manner in which it is wrapped along the core can make a difference on some bands. Of course, the length of the whip makes a considerable difference as well.

The instructions warn, in very blunt terms, that the braid of your coax *must* be grounded near the base of the antenna. They also stress that the ground must be "perfect" to achieve reasonable performance. I use a magnetic mount with my *Ham Stick* mobile antennas, but my mount is also grounded at the base with a length of copper braid and a wing nut for easy removal. It makes a huge difference in tuning and overall performance. That's why I had to smile when I read the following words, printed on their instruction sheet in bold type: **NO GROUND—NO WORK!** (No kidding!)

I did *not* attempt to trim the whips. A length that would work for the antenna installation aboard my Saturn SL-2 could be completely out of the ballpark for another vehicle. Instead, I used the whips untrimmed and adjusted the winding of the wander lead.

To my surprise, I was able to achieve SWRs of less than 2:1 on every band except 80 meters. As you would expect, the 2:1 SWR bandwidth narrows as you go lower in frequency. On 2 meters, for example, I enjoyed a bandwidth of nearly 3 MHz. On

20 meters it shrank to 300 kHz, and on 40 meters it was down to a little less than 200 kHz.

As I analyzed each band, it was obvious that I could probably obtain SWRs of 1.5:1 or less if I used the shorter whip and trimmed accordingly. I'd have to be very careful, however, and trim in short increments, probably targeting 80 meters first. With luck, a decent SWR on 80 meters would be reflected (no pun intended!) on the other bands as well. I've been a ham too long not to respect the Murphy factor, though. The classic nightmare is that you'd obtain a fine SWR on 80 meters, only to find that the antenna was wildly out of whack on every other band. My gut feeling—completely untested, mind you—is that the Multiwhip will load as advertised if you employ patience, common sense and a good ground.

Performance

All HF mobile antennas represent a compromise. To make it possible to operate from our cars and trucks with reasonably short antennas, you sacrifice radiation efficiency. Low-profile HF antennas, such as the monoband helically wound sticks and similar designs, offer acceptable efficiency on the higher bands, but their performance declines markedly on 40 and 80 meters. To obtain improved performance on the low bands you must depart the low-profile realm and choose the more "obvious" antennas—you know, the ones with the huge loading coils and pizza-sized capacitance hats.

The Multiwhip falls into the low-profile category, although it is somewhat more imposing than your typical Hamstick or Outbacker. (And then there is that bright green sheen to consider, too!) In my entirely nonscientific, subjective tests, I swapped the Multiwhip for a Hamstick on each band. (I used a tuner to load it on 80 meters.) I observed received signal strengths and made several contacts on each band.

The antennas appeared to perform almost identically on the HF bands. My Hamstick seemed to have a slight edge over the Multiwhip on 20 meters, but that was the only HF band where I could detect a difference. The Multiwhip seemed somewhat better than the Hamstick on 6 meters. On 2 meters I use a small, quarter-wavelength whip on the trunk. As you'd expect, the towering Multiwhip outperformed my tiny antenna by a wide margin.

On the road the Multiwhip held its own quite well. I managed to *twang* a couple of trees and one parking garage roof. No problem for the Multiwhip. And despite its weight, my mag-mount remained firmly attached to the trunk lid.

If you want seven-band coverage all the way to 2 meters, and you can countenance reduced efficiency on the lower HF bands, the Multiwhip is certainly worth consideration. I was able to jump out of my Saturn, change the band tap on the Multiwhip, and jump back behind the wheel in 30 seconds. That's much more convenient than unscrewing one antenna and replacing it with another. With the Multiwhip I enjoyed 80 through 2-meter operation on *one* antenna—no need to erect a mobile antenna farm to take advantage of the HF-to-VHF coverage my rig (an ICOM IC-706) provides.

Manufacturer: Antronic, Pinetown, South Africa; distributed in the US as the Model AN-7 by Palomar, Box 462222, Escondido, CA 92046; tel 760-747-3343; fax 760-747-3346; e-mail **palomar@compuserve.com**. Manufacturer's suggested retail price, $249.

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