A Vertical End-Fed Dipole with a Folded Stub Page 34

QST
DIGITAL EDITION

ARRL The national association for AMATEUR RADIO®
July 2020 www.arrl.org
DEVOTED ENTIRELY TO AMATEUR RADIO

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QST Reviews

ACOM 1200S 160 – 6 Meter Linear Amplifier

Midnight Design Solutions Phaser Digital Mode Transceiver Kit

Palstar DL2K High-Power Dummy Load

AlexTune Visual Tuning Indicator for Mag-Loop Antennas

The radio... YAESU

Inherent Passion and Inspiration

Hybrid SDRs (Narrow Band SDR & Direct Sampling SDR)

2kHz RMDR 123dB+
2kHz BDR 150dB+
2kHz 3rd IMDR 110dB+

Ultra Low-Noise Local Oscillator System; 400MHz HRDDS
(High Resolution Direct Digital Synthesizer)

2kHz Phase Noise −150dBc/Hz

VC-TUNE (Variable Capacitor Tune) signal peaking

Maximum Attenuation −70dB

3DSS (3-Dimensional Spectrum Stream) visual display
view up to last 25 seconds of band conditions in real time

TX Signal Purity

TX Phase Noise −150dBc/Hz (TX 14MHz 2kHz separation)

* Microphone M-1: Optional

In Homage to the Founder of Yaesu – Sako Hasegawa JA1MP

FTDX101MP 200W
HF/50MHz TRANSCEIVER

- External Power Supply with 3.94" (100mm) Front Speaker, FPS-101 included
- VC-Tune unit × 2 (MAIN and SUB bands) included
- 300Hz Crystal roofing filter (MAIN band) included
- 600Hz Crystal roofing filter (MAIN and SUB bands) included
- 3kHz Crystal roofing filter (MAIN and SUB bands) included

The Ultimate

FTDX101D 100W
HF/50MHz TRANSCEIVER

- VC-Tune unit (MAIN band) included
- 600Hz Crystal roofing filter (MAIN and SUB bands) included
- 3kHz Crystal roofing filter (MAIN and SUB bands) included

YAESU
The radio

YAESU USA
6125 Phyllis Drive, Cypress,
CA 90630 (714) 827-7600

For the latest Yaesu news, visit us on the Internet: **http://www.yaesu.com**

Specifications subject to change without notice. Some accessories and/or options may be standard in certain areas. Frequency coverage may differ in some countries. Check with your local Yaesu Dealer for specific details.

YAESU
The radio

High Visibility and Operation with a High-Resolution Full Color TFT & Touch Screen Display Superior Performance in a Compact C4FM Digital Transceiver

- System Fusion II Compatible
- Compact & Reliable 5W RF Power Output
- 700mW of C4FM Exceptional Quality Audio
- Dual band Simultaneous Receive
- High Visibility Full-Color TFT touch panel Display
- Built-in High Precision GPS Receiver
- Easy Hands-Free Operation with Built-in Bluetooth® unit
- High-Resolution and High-Speed 79 channel Band scope
- CAM (Club channel Activity Monitor) Function
- FM Friendly Digital by AMS (Automatic Mode Select)
- WIRES-X Portable Digital Node Function

《Actual Size》

C4FM/FM 144/430MHz DUAL BAND DIGITAL TRANSCEIVER

FT3DR

Bluetooth®

microSD Card

C4FM Digital Quality Advance
Clear and Crisp Voice Technology

AMS Automatic Mode Select

66 ch GPS

YAESU
The radio

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6125 Phyllis Drive, Cypress,
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Cushcraft...Keeping You in Touch Around the Globe

Cushcraft Antennas

R9

80-6 Meters! No Radials!

Cushcraft's world famous R8 now has a big brother!

Big Brother R9 now includes 75/80 Meters for local ragchewing and worldwide low band DX without radials!

It's omni-directional low angle radiation gives you exciting and easy DX on all 9 bands: 75/80, 40, 30, 20, 17, 15, 12, 10 and 6 Meters with low SWR. QSY instantly – no antenna tuner needed.

Use full 1500 Watts SSB/CW when the going gets tough to break through pileups and poor band conditions.

The R9 is super easy to assemble, installs just about anywhere, and its low profile blends inconspicuously into the background in urban and country settings alike.

Compact Footprint: Installs in an area about the size of a child's sandbox – no ground radials to bury with all RF-energized surfaces safely out of reach.

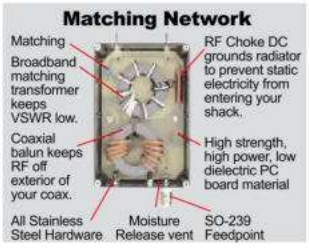
Rugged Construction: Thick fiberglass insulators, all stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

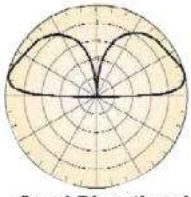
31.5 feet tall, 25 lbs. Mounting mast 1.25 to 2 inches. Wind surface area is 4 square feet.

R8, $599.95. Like R9 antenna but less 75/80 Meters.

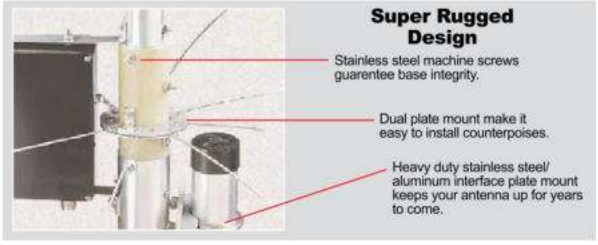
R-8TB, $99.95. Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

R-8GK, $79.95. Three-point guy kit for high winds.





Omni-Directional
Low angle radiation gives incredible worldwide DX.



Cushcraft...Keeping You in Touch Around the Globe!

Cushcraft **Amateur Radio Antennas** 308 Industrial Pk Rd, Starkville, MS 39759 USA
Sales/Tech: (662) 323-9538 ■ **FAX:** (662) 323-5803 Open 8-4:30 CST, Mon.-Fri.

COMET®

Life is a JOURNEY. Enjoy the ride!

CHA-250B - *No Antenna Tuner Needed!*

❶ ❷ ❸ ❹ ❺ ❻ ❼

Base Antennas

❶ COMET CHA-250B BROADBAND 80M THROUGH 6M VERTICAL ANTENNA

A newly designed broadband vertical with NO GROUND RADIALS. EXTREMELY easy to assemble, requires no tuning or adjustments and VSWR is under 1.5:1 from 3.5-57MHz! • TX: 3.5MHz – 57MHz • RX: 2.0– 90MHz • VSWR is 1.5:1 or less, continuous • Max Power: 250W SSB/125W FM• Impedance: 50 Ohm • Length: 23' 5" • Weight: 7 lbs. 1 oz. • Conn: SO-239 • Mast Req'd: 1" – 2" dia. • Max wind speed: 67MPH

❷ Maldol HVU-8 ULTRA-COMPACT 8 BAND HF/VHF/UHF VERTICAL ANTENNA

80/40/20/15/10/6/2M/70cm Only 1/2 the traditional size and weight of vertical HF antennas, and it includes 2M/70cm! Unique radial system rotates for balcony installations, the radials can all be rotated to one side. • Wavelength: HF and 6M: 1/4 wave • 2M: 1/2 wave • 70cm: Two 5/8waves in phase • Impedance: 50 Ohm • Max Power: HF 200W SSB • 6M–70cm: 150W FM• Conn: SO-239 • Height: Only 8'6" • Weight: 5lbs. 7ozs.

❸ COMET GP-3 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Max Pwr: 200W • Length: 5'11"• Weight: 2lbs. 9ozs. • Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

❹ COMET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2"• Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

❺ COMET GP-9 / GP-9N DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

BEST SELLER! • Wavelength: 146MHz 5/8 wave x 3 • 446MHz 5/8 wave x 8 • Max Pwr: 200W• Length: 16' 9"" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

❻ COMET CX-333 TRI-BAND 146/220/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 2 • 220MHz 5/8 wave x 3• 446MHz 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz.• Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

❼ COMET GP-15 TRI-BAND 52/146/446MHZ BASE REPEATER ANTENNA

Wavelength: 52MHz 5/8 wave • 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 4 • Max Pwr: 150W • Length: 7'11" • Weight: 3lbs. 1oz. • Conn: Gold-plated SO-239• 2MHz band-width after tuning (6M) • Construction: Single-piece fiberglass

NEW

CAA-500MarkII

1.8-500MHz Antenna analyzer

The CAA-500MarkII combines the simplicity and accuracy of an analog instrument, PLUS…a full color LCD graphic display • Resistive (R) and Reactive (X) components of impedance graphed and displayed numerically • SWR readings in both graphic and numerical results.

Operates on 8-16VDC external power, 6 AA Alkaline or NiMH rechargeable cells • Trickle charger built in (only when using NiMH batteries) • Typical battery life: 9 hours of continuous operation • Battery level indicator • Selectable auto power-off time limit preserves battery capacity • SO-239 connector for 1.8-300MHz range • N-female connector for 300-500MHz range

The perfect combination of analog and graphic information, designed in particular for antenna diagnostics and adjustments while on the roof, tower or in the field!

CAA-5SC

Protect your CAA-500MarkII from moisture, shock, dents and dings!

Shoulder strap included.

Call or visit your local dealer today!

www.natcommgroup.com | 800-962-2611

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QST

Contents

July 2020 ♦ Volume 104 ♦ Number 7

Includes video
Includes audio
Additional content

Columns

Departments

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ARRL members can access the digital edition via a link at **www.arrl.org/qst**, download our iOS app from the iTunes Store, and download our Android app from the Google Play Store.

Our Cover
With stay-at-home mandates in place all over the country, amateur radio clubs are finding new ways to stay connected. Read about how Lee Chambers, KI7SS; Phil Cornell, W7PLC, and their club, the Olympia (Washington) Amateur Radio Society, learned how to use videoconferencing technology to keep active and stay in touch, in "Online Club Meetings Ease Shelter-in-Place Isolation," on page 61 of this issue.
[Kevin Sterjo, illustration]

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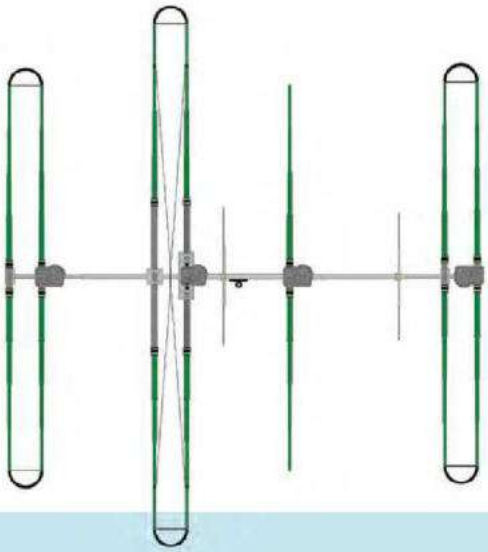
THANK YOU

To all of our customers and supporters!

Throughout the years, we have had an incredible amount of support, guidance, input, constructive criticism and above all, helpful words of advice and encouragement from our customers. I remember when Mike K7IR, Jim K7IRF and I started this company in 2001, hams were so motivated to help us grow (we were working out of Jim's garage back then) they would order every single option on an antenna "just to be sure we made it", even though they had no actual need for some (or in some cases ANY) of those options. We were so thankful back then for that uncommon support, and that feeling has never changed – Now here we are in the midst of one of the great tragedies in our modern world, and our customers continue to give us the same kind of love, that fantastic support that has kept us motivated to continue driving to be the very best in our field. So instead of promoting a particular product this month, we would like to say a simple and sincere THANK YOU to everyone that has supported SteppIR over the years, those that are leading the charge now and of course to those future customers. Thanks to you we are alive and well, and ready to help!



On behalf of all of us at SteppIR – 73

John Mertel WA7IR President/CEO

FLASH SALE ON EVERYTHING!

We would like to announce a FLASH sale to celebrate our 19th year of operation!

From June 10 thru 15, 2020 save 10% off of any order placed with SteppIR – online*, email or call-in.

* Online orders will be credited the discount on final invoice but will not show discount when placing order

19

NINTEEN YEARS

steppIR COMMUNICATION SYSTEMS

FOR PRODUCT DETAILS AND ORDERING:

www.steppir.com 425-453-1910

DIAMOND ANTENNA

diamondantenna.net

When it comes to quality and performance, DIAMOND ANTENNA is the worldwide leader in VHF/UHF base and mobile antennas.

DIAMOND ANTENNAS help you get the most out of your on-air experience.

For all your base station and repeater needs, DIAMOND has an antenna that will work for you.

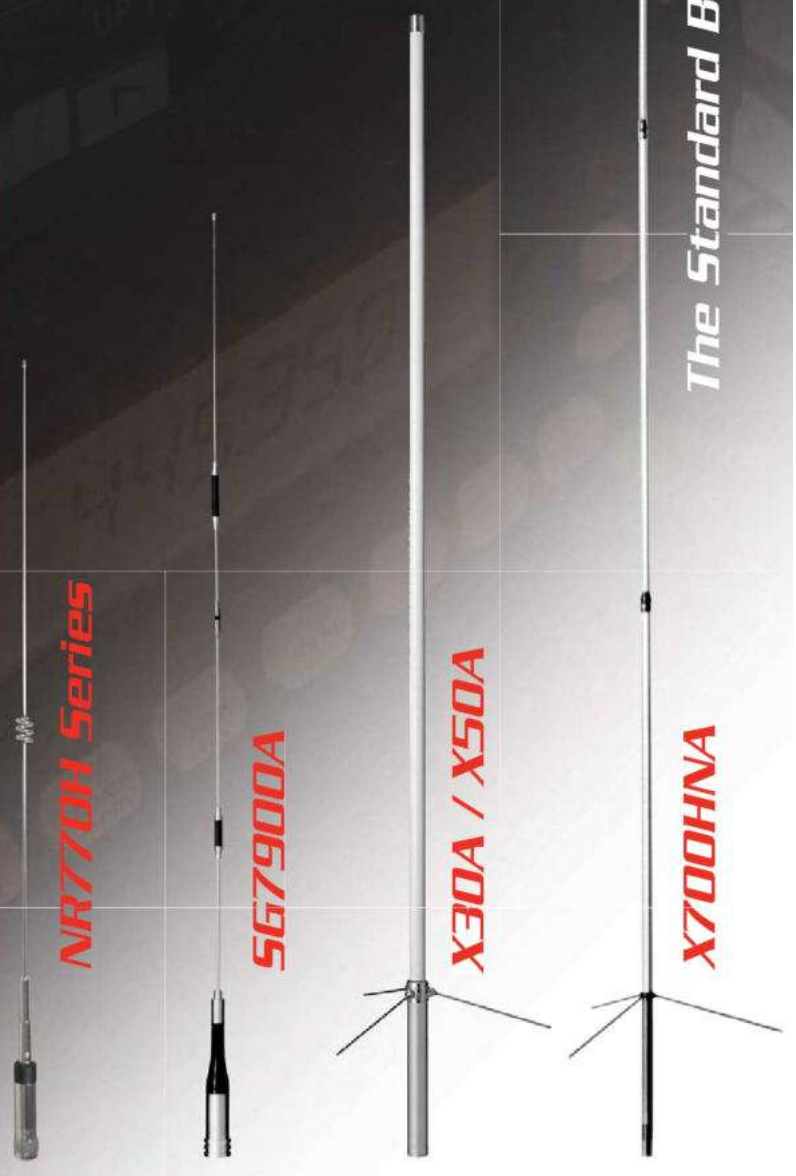
You've tried the rest, now own the best!

X700HNA Special Features:

- Heavy duty fiberglass radomes
- Four section assembly
- Overlapping outer shells for added strength
- Stainless steel mounting hardware & radials
- Strong waterproof joint couplings
- Type-N cable connection
- Wideband performance
- Highest gain Dual-band Base Antenna!

Here is a small sample of our wide variety of antennas

Model	Bands	Length Ft.	Max Pwr. Rating	Conn.
Dualband Base Station/Repeater Antennas				
X700HNA (4 section)	2m/70cm	24	200	N
X510HD (3 Section)	2m/70cm	17.2	330/250	UHF or N
X300A (2 Section)	2m/70cm	10	200	UHF or N
X200A (2 Section)	2m/70cm	8.3	200	UHF
X50A (1 Section)	2m/70cm	5.6	200	UHF or N
X30A (1 Section)	2m/70cm	4.5	150	UHF
Monoband Base Station/Repeater Antennas				
F23H (3 Section)	144-174 MHz (W/ Cut Chart)	15	350	UHF
F22A (2 Section)	2m	10.5	200	UHF
CP22E (Aluminum)	2m	8.9	200	UHF
F718A (Coax Element)	70cm	15	250	N
Dualband Mobile Antennas				
SG7900A	2m/70cm	62.2 in.	150	UHF or NMO
SG7500A	2m/70cm	40.6 in.	150	UHF or NMO
NR770H Series	2m/70cm	38.2 in.	200	UHF or NMO
MR77 Series	2m/70cm	20 in.	70	Mag Combo
AZ504FXH	2m/70cm	15.5 in.	50	UHF
AZ504SP	2m/70cm	15.5 in.	50	UHF
NR7900A	2m/70cm	57 in.	300/250	UHF
Monoband Mobile Antennas				
NR22L	2m	96.8 in.	100	UHF
M285	2m	52.4 in.	200	UHF or NMO



The Standard By Which All Others Are Judged

RF PARTS™ COMPANY

Diamond Antenna is a division of RF Parts Company

Kris Bickell, K1BIC, ARRL Lifelong Learning Manager, kbickell@arrl.org

Second Century

Learning — The Journey of A Lifetime

As an educator, one of my favorite sayings is, "Learning is a journey, not a destination." For most of us, learning is a lifelong endeavor in many areas of our lives. Sometimes we are not even aware of it, as learning often occurs informally. We begin learning as young children by observing the world around us. Then we go to school to learn in a more formal manner. Some of us go back to school years later to get advanced training. We continue to learn on the job, we adjust to new trends and new technology, and we explore new interests as our lives change.

Through the years, the learning journey in amateur radio hasn't changed much, but the way people learn has changed dramatically. Today, you can find the answer to virtually any question wherever you are, whenever you want, using your smartphone. On a personal note, my career path — online learning — wasn't even a possibility back when I was in college, with personal computers and smartphones still years away.

Currently, the number of amateur radio licensees remains relatively steady. However, data shows that the number of active ARRL members is not keeping pace, as many of these new licensees don't become active in ham radio despite the resources around them. Passing the exam and obtaining a license has become the point where many hams' journeys come to a halt. ARRL wanted to know why this was happening, and what could be done to change it.

We conducted research that provided some very helpful clues. People who have their amateur radio license but stopped engaging with ham radio — or who were never active — were asked what, if anything, might have helped them stay (or become) active. The most common response was, "Help with how to get started on the air." These respondents also indicated that they would prefer this training to be delivered using online videos or multimedia.

This information, along with the increasing popularity of self-guided learning using the internet, where people can find answers to virtually any question at any time, has been the catalyst in the development of ARRL's Lifelong Learning program.

As part of ARRL's Second Century, and to align with the way many associations now provide education to their communities, ARRL's Lifelong Learning program is looking to add a modern touch to the way new hams learn. By taking into account the increasing popularity of online videos and tutorials, ARRL is developing an online learning center to serve as a hub that new licensees and those seeking to expand their level of knowledge will use to further their own learning journey.

This learning center will focus on three main content tracks, all of which were identified in the research as the most common areas of interest for amateur radio enthusiasts: Electronics & Technology, Personal Communications, and Emergency Communications. Ideally, this learning center will serve as a bridge to the larger ham radio community and the resources already in place.

2020 has been a challenging year for learning, with the pandemic forcing educators and students from preschool to college to teach, learn, and work remotely. But even though this situation comes with many challenges, it highlights the increasing popularity of online learning, providing ARRL with the perfect opportunity to offer this type of service to the entire ham radio community, while adding even more value to ARRL membership.

We hope you join in as the learning journey at ARRL continues in 2020 and beyond!

Kris Bickell, K1BIC
Lifelong Learning Manager

Free Catalog/Dealers/Manuals Online – Visit: www.hy-gain.com or call toll-free 800-647-1800

The First Choice of Hams Around the World!

hy-gain® HF Beams

...are stronger, lighter, have less wind surface and last years longer.

Why? hy-gain uses durable tooled components – massive boom-to-mast bracket, heavy gauge element-to-boom clamps, thick-wall swaged tubing – virtually no failures!

TH-11DX, $1299.95. 11-element, 4.0 kW PEP, 10, 12, 15, 17, 20M

The choice of top DXers.

With 11-elements, excellent gain and 5-bands, the super rugged TH-11DX is the "Big Daddy" of all HF beams!

Handles 2000 Watts continuous, 4000 Watts PEP.

Every part is selected for durability and ruggedness for years of trouble-free service.

Features a low loss logperiodic driven array on all bands with mono-band reflectors, BN-4000 high power balun, corrosion resistant wire boom support, hot dipped galvanized and stainless steel parts.

Stainless steel hardware and clamps are used on all electrical connections.

TH-7DX, $999.95. 7-element, 1.5 kW PEP, 10, 15, 20 Meters

7-Elements gives you the highest average gain of any hy-gain tri-bander!

Dual driven for broadband operation without compromising gain. SWR less than 2:1 on all bands.

Uniquely combining monoband and trapped parasitic elements give you an excellent F/B ratio.

Includes hy-gain's diecast aluminum, rugged boom-to-mast clamp, heavy gauge element-to-boom brackets, BN-86 balun. For high power, upgrade to BN-4000.

Compact 3-element 10, 15, 20 Meter Tri-Bander

For limited space...Installs anywhere...14.75 ft turning radius... weighs 21 lbs...Rotate with CD-45II, HAM-IV

Fits on light tower, suitable guyed TV pole, roof tri-pod

TH-3JRS, $419.95. hy-gain's most popular 3-element 10, 15, 20 Meter tribander fits on most lots! Same top performance as the full power TH3MK4 in a compact 600 watt PEP design.

Excellent gain and F/B ratio let you compete with the "big guns".

Tooled manufacturing gives you hy-gain durability with 80 MPH wind survival.

TH-5MK2, $879.95. 5-element, 1.5 kW PEP, 10,15, 20 Meters

The broadband five element TH5-MK2 gives you outstanding gain.

Separate air dielectric Hy-Q™ traps let you adjust for maximum F/B ratio on each band.

Also standard is hy-gain's exclusive BetaMATCH™, stainless steel hardware and compression clamps and BN-86 balun.

TH-3MK4, $549.95. 3-element, 1.5 kW PEP, 10,15, 20 Meters

The super popular TH-3MK4 gives you the most gain for your money in a full-power, full-size durable hy-gain tri-bander!

You get an impressive average gain and a whopping average front-to-back ratio. Handles a full 1500 Watts PEP. 95 MPH wind survival.

Fits on average size lot with room to spare -- turning radius is just 15.3 feet.

Four piece boom is ideal for DXpeditions. Rotates with CD-45II or HAM-IV rotator.

Features hy-gain BetaMatch™ for DC ground, full power Hy-Q traps, rugged boom-to-mast bracket and mounts on standard 2"O.D. mast. Stainless steel hardware. BN-86 balun recommended.

TH-2MK3, $449.95. 2-element, 1.5 kW PEP, 10,15, 20 Meters

The 2-element TH-2MK3 is hy-gain's most economical full power (1.5kW PEP) full size tri-bander.

For just $339.95 you can greatly increase your effective radiated power and hear far better!

Ruggedly constructed, top-performing, compact 6 foot boom, tight 14.3 foot turning radius. Installs almost anywhere. Rotate with CD-45II or HAMIV. BN-86 balun recommened.

EXP-14, $699.95. 4-element, 1.5 kW PEP, 10,15, 20 Meters

Revolutionary 4-element compact tri-bander lets you add 40 or 30 Meters! Has 14 foot boom and tight 17.25 feet turning radius. Fits on roof tri-pod, mast or medium duty tower.

hy-gain's patented broadbanding Para Sleeve gives you less than 2:1 VSWR. 1.5kW PEP.

BetaMATCH™ provides DC ground to eliminate static. Includes BN-86 balun. Easily assembled.

Truly competitive against giant tri-banders at half the cost!

QK-710, $199.95. 30/40 Meter option kit for EXP-14.

Tooled Manufacturing... Highest Quality Materials

1. **hy-gain's** famous super strong tooled die cast Boom-to-Mast Clamp
2. **Tooled** Boom-to-Element Clamp
3. **Thick-wall** swaged aluminum tubing

Tooled manufacturing is the difference between hy-gain antennas and the others -- they just don't have it (it's expensive!).

Die-cast aluminum boom-to-mast bracket and element-to-boom compression clamps are made with specially tooled machinery.

hy-gain antennas feature tooled swaged tubing that is easily and securely clamped in place. All tubing is deburred and cleaned for smooth and easy assembly.

Durable precision injection molded parts.

hy-gain antennas are stronger, lighter, have less wind surface area, better wind survival, need no adjustments, look professional and last years longer.

Model No.	No. of elements	avg gain dBd	avg F/B dB	MaxPwr watts PEP	Bands Covered	Wind sq. ft. area	Wind (mph) Survival	Boom feet	Longest Elem. (ft)	Turning radius (ft)	Weight (lbs.)	Mast dia O. D. (in.)	Recom. Rotator	Sugg. Retail
TH-11DX	11	For Gain and F/B ratio–See... • www.hy-gain.com • hy-gain catalog • Call toll-free 800-973-6572		4000	10, 12, 15, 17, 20	12.5	100	24	37	22	88	1.9-2.5	T2X	$1299.95
TH-7DX	**7**			**1500**	**10, 15, 20**	**9.4**	**100**	**24**	**31**	**20**	**75**	**1.5-2.5**	**HAM-IV**	**$999.95**
TH-5MK2	5			1500	10, 15, 20	7.4	100	19	31.5	18.42	57	1.5-2.5	HAM-IV	$879.95
TH-3MK4	**3**			**1500**	**10, 15, 20**	**4.6**	**95**	**14**	**27.42**	**15.33**	**35**	**1.9-2.5**	**CD-45II**	**$549.95**
TH-3JRS	3			600	10, 15, 20	3.35	80	12	27.25	14.75	21	1.25-2.0	CD-45II	$419.95
TH-2MK3	**2**			**1500**	**10, 15, 20**	**3.25**	**80**	**6**	**27.3**	**14.25**	**20**	**1.9-2.5**	**CD-45II**	**$449.95**
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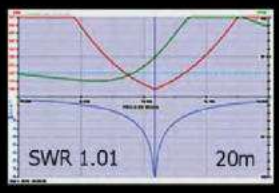

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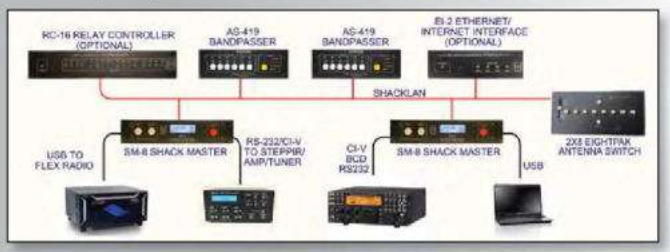

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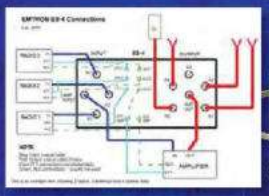

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Member Spotlight

Alan Wolke, W2AEW

There are a couple of ways you might have made Alan's, W2AEW, acquaintance. One is on the air, of course, as he likes a friendly ragchew on HF a few nights a week. The other is online — on his YouTube channel, **www.youtube.com/w2aew**, a collection of more than 300 informative videos on electronics and ham radio topics that has garnered more than 125,000 subscribers and over 15 million views.

Birth of a YouTuber

The channel started about 10 years ago, with a short video that Alan did just for fun, of his QRP operation at a hamfest. Things started to take off when Alan made a how-to video for a ham friend who wanted to learn how to use a Tektronix oscilloscope. Alan, who works for Tektronix, sent his friend the YouTube link to the video, and didn't think much of it until about a week later, when he saw that the video had been viewed about 100 times.

That inspired Alan to go farther with video. "I like covering the basics of things so people can get an understanding of technical topics," he said. "That's part of what I do for work. As an application engineer, I do a lot of teaching, to tell people how to use an instrument, or how to make a particular measurement. So I figured I'd make a channel based on that."

The basis of Alan's channel is an ongoing list of potential topics, many of which are drawn from questions and comments that viewers leave on his videos. Once he chooses a topic to work on, he makes notes, shaping them until he feels he can tell a cohesive story. Alan says this process is "about 75% of the work," and it shows in his concise, informative videos, which are often less than 10 minutes long. He uploads a new video every month or two.

Amateur Extra-class ham Alan Wolke, W2AEW, serves as Technical Coordinator for ARRL's Northern New Jersey Section and runs a popular YouTube channel.

Going Viral

Ten years into its existence, Alan's YouTube channel averages 6 – 7 thousand views a month, and 30 – 40 comments from viewers each day. His most popular video, on how to understand op-amp circuits, is 7 years old and has been viewed more than 600,000 times.

The channel has even spawned a viral video. About 5 years ago, Alan made a short video on how to coil cable so it doesn't develop a twist. "You can…take one end of it and toss it out, and it'll all lay out straight," he said. "I thought, 'I ought to show people how to do that.'" Someone appreciated the tip so much, they posted the video to a Reddit forum about lifehacks. It went "geek viral," as Alan described it, jumping to about 40,000 views literally overnight. The video's views currently stand at about 80,000.

The Power of a Mentor

Alan's not in it for the views, though. He gets enjoyment out of helping others learn about electronics, ham radio, test measurement, and RF. He credits his high school electronics teacher, Charles Burke, WA2SLK, with helping him get started in electronics and ham radio years ago, which led to his career at Tektronix. "I really appreciate what he did in terms of giving me a direction for my career and my hobby," Alan said. "I've been told that I'm pretty good in breaking things down into easy-to-understand language… I felt I could help mentor." He reads every comment that viewers leave on his videos, and responds to as many of them as he can, helping fellow hobbyists figure things out, getting ideas for new videos and, of course, making new friends along the way.

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SWR Protection prevents amplifier damage if you switch to a wrong band, use the wrong antenna or have high SWR.

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Up Front

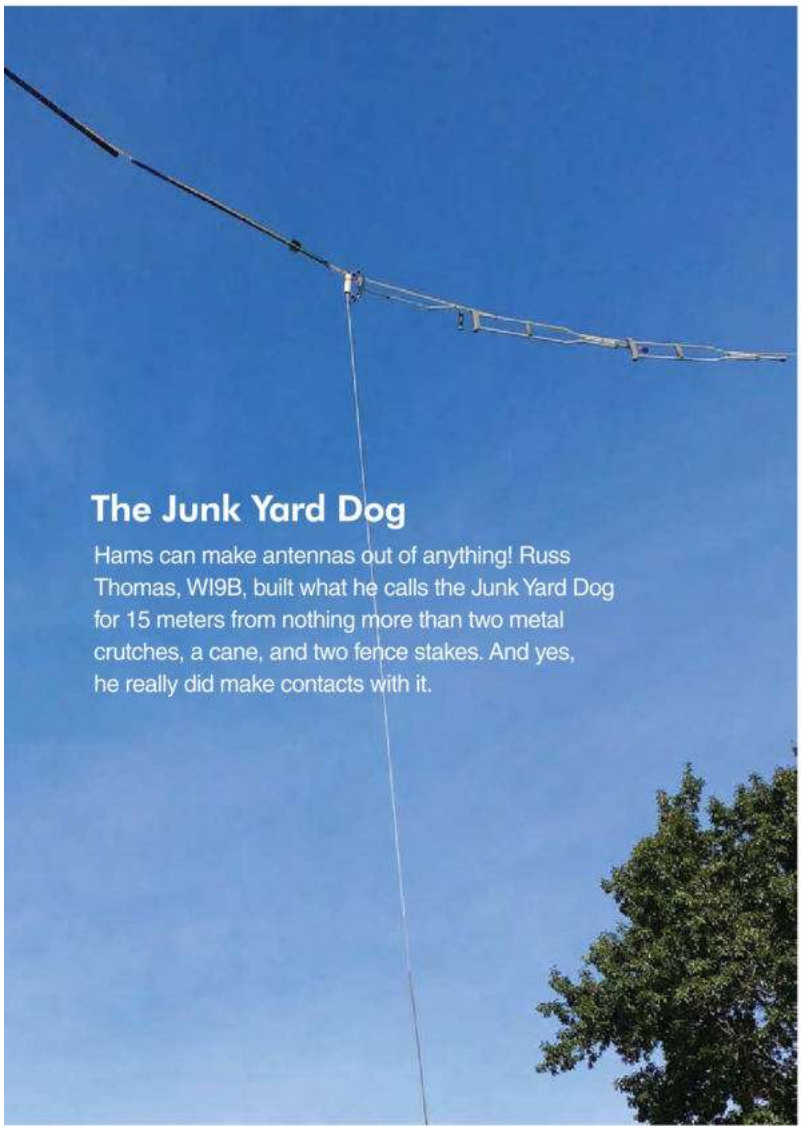
First Contact

Working with her colleague and director of the Young Scientists Program (YSP), DJ Kast, Dr. Rita Barakat, KN6CHS, at the University of Southern California, applied to host an amateur radio contact with the International Space Station as part of the ARISS (Amateur Radio on the International Space Station) program. They hoped to set up the contact with one of their partnered schools in the Los Angeles Unified School District.

Dr. Rita Barakat, KN6CHS, introduces two students to ISS Commander Luca Parmitano.

Dr. Barakat's application was eventually accepted, so she met with ARISS technical mentors and educational ambassadors in the area, most notably Brian Johnson, AB6UI; Darrell Warren, KA6OSC; Bob Koepke, AA6TB, and Norm Thorn, K6UU. They dedicated hours and days to setting up, tuning, and testing the antennas (one directional and two backup omnidirectional antennas) and other equipment leading up to the actual contact on October 28, 2019.

The student audience at the Vermont Avenue Elementary School were thrilled to hear the voice of ISS Commander Luca Parmitano coming through the speaker system as the space station streaked overhead. They asked several excited questions before the station slipped over the horizon just minutes later.



The Junk Yard Dog

Hams can make antennas out of anything! Russ Thomas, WI9B, built what he calls the Junk Yard Dog for 15 meters from nothing more than two metal crutches, a cane, and two fence stakes. And yes, he really did make contacts with it.

Who's Behind the "Curtain?"

This antenna is more than just a curiosity; it really works. It is a scale model of the 4 × 2 curtain array (a stack of 4 high by 2 wide driven elements, with a screen reflector) used by the Voice of America Bethany (Ohio) Relay Station until their last transmission in November 1994. Unlike the massive HF array at Bethany, this model is designed for 70 centimeters. It was created by West Chester Amateur Radio Association members Richard Kreuter, WC8RK, and Joe Burke, WA8OGS.

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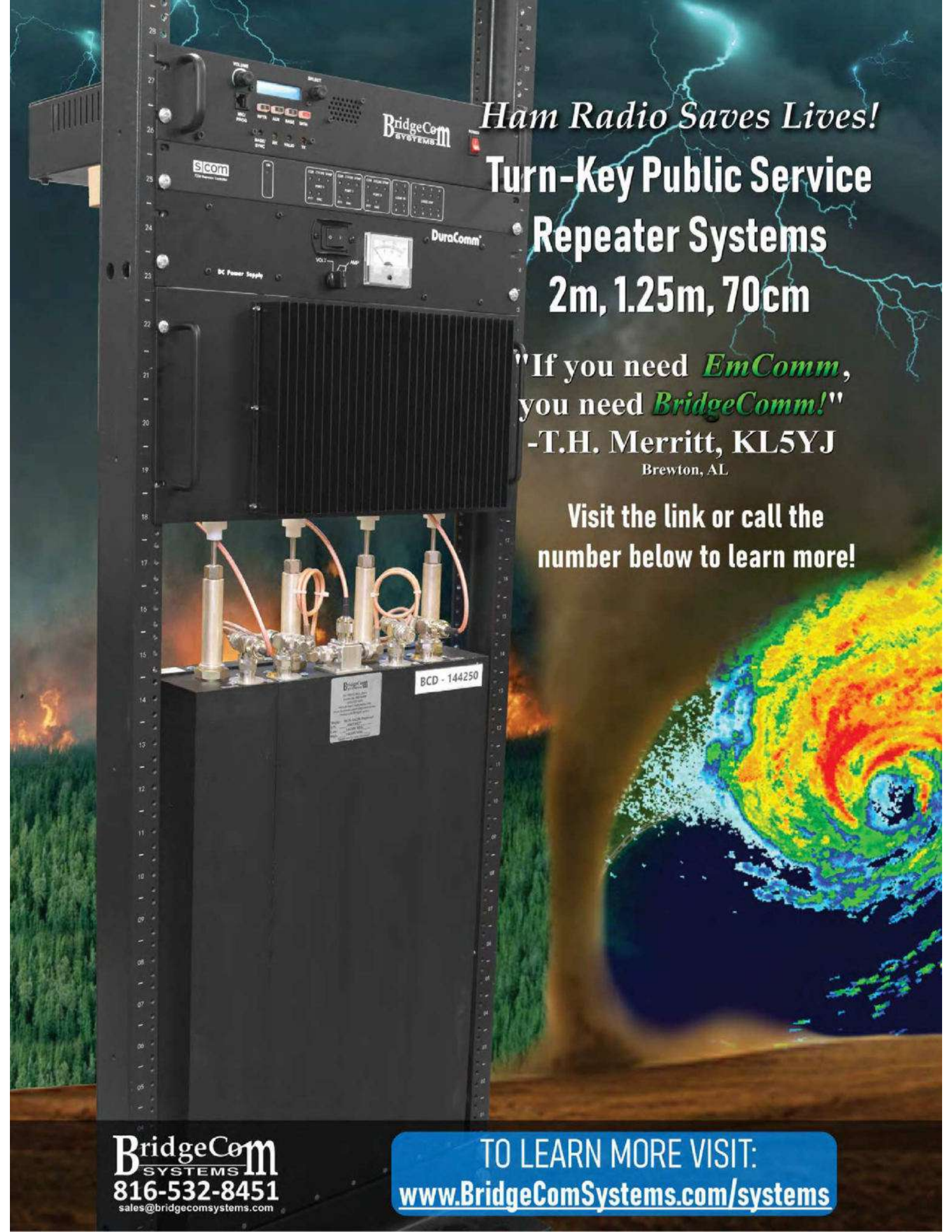
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Letters from Our Members

A Challenge for Active DXers

Although the DXCC Challenge has been stimulating for me, I've often thought a Triple Play Challenge would add another exciting element to the mix.

Working and confirming countries on phone, CW, and digital modes on any one band has always been a personal challenge and has enabled me to stay interested and active on all the available modes. Being able to keep track of it through Logbook of The World (LoTW) would be a bonus and I believe many active DXers would embrace it. It might encourage more multimode operation and give those at the top of the Honor Roll more to work on in addition to the already exciting DXCC Challenge.

I marvel at those who have reached the 3,000 mark, but imagine someone reaching the 9,000 mark? Now that's a real challenge!

Jeff Schwartz, KIØKB
Greeley, Colorado

A Bright Idea for a Contact

In 1964 in central Florida, I was experimenting with my Globe Scout 680A transmitter. On a whim, I connected my desk lamp (including about 6 feet of zip cord) to the antenna connection. It was a dummy load, of sorts. While I was watching the light flash in synchronization with my CW, I was startled to hear a YV5 call sign come back to me. I quickly switched the transmitter to my dipole, to which the receiver was already connected, and had a nice contact. It was one of those surprising, unforgettable radio moments.

Alan Biddle, WA4SCA
Franklin, Tennessee
Life Member

Thank You for *QST*

I am 14 years old and earned my Amateur Extra-class license about 1 year ago, shortly after testing for my Technician- and General-class licenses (both of which I earned on the same night).

After becoming an ARRL member, I read my first issue of *QST* from cover to cover (even the ads) and loved it! The editors do an awesome job. I continue to read each issue front to back (sometimes I get in trouble because I read it through midnight). I also enjoy reading the technical articles and I am starting to understand it better.

Jakin Messer, AG7WW
Dorena, Oregon

Touchscreen Radios Lack Inclusivity

Many blind hams I've spoken with in my area don't like the new generation of radios that use oversized touchscreens. Bluntly put, they are useless to a sight-challenged person, as most of them don't announce what button or area of the screen is being touched.

I would like to see the big manufacturers take notice of this and do something to fix it. Our ham community should be inclusive, and equipment should be made easier to use for disabled people. I submit that instead of designing proprietary schemes to address this issue, all radio manufacturers should settle on a common standard to implement this. Along the same lines, there should be more Bluetooth options in radios, and a common scheme should be adopted to all car radios.

Stan Wilk, NK9A
Union Pier, Michigan

Spotting an Old Error

I noticed in the "Celebrating Our Legacy" column in the April issue that the image of the single-tube receiver from the 1939 *Wolf Cub Scout Handbook* appears to have an error. In the schematic for the single-tube receiver, the battery is labeled backwards: the plus sign is on the negative end of the battery and vice versa. The pictorial, however, is correctly labeled.

I sure hope this didn't cause any of those 1939 Cub Scouts any difficulty!

Andi Tepper, W3NB
Rockville, Maryland
Life Member

One Ham's Legacy

I enjoyed reading "100, 50, and 25 Years Ago" in the May 2020 issue. Included in this column was the May 1995 cover (25 years ago), which was a photograph of my father, W4AT (SK).

Seeing the cover of that issue brought back many emotions. He used to say that being a licensed amateur radio operator did more for him than his Harvard degree. That attitude caused five of his six children to become licensed operators. I'm also proud to say that my son is now a fourth-generation ham in our family.

Thank you for your commemoration of the May 1995 issue.

Claude Hennessey, W4AT
Fairfax, Virginia

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W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1300		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	1400-1600 1700-1945	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	2000	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2100	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2200	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	2300	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0000	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0100	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	0145	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	0200	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0300	CODE BULLETIN				

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US time + 4 hours. For the rest of the year, UTC = Eastern US time + 5 hours.

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675, 50.350, and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13, and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13, and 10 WPM.

Code bulletins are sent at 18 WPM.

For more information, visit us at
www.arrl.org/w1aw

♦ W1AW Qualifying Runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted by various West Coast stations on CW frequencies that are normally used by W1AW, in addition to 3590 kHz, at various times. Underline 1 minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any), and complete mailing address. Fees: $10 for a certificate, $7.50 for endorsements.

♦ Digital transmissions: Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095, 50.350, and 147.555 MHz.

Bulletins are sent using 45.45-baud Baudot, PSK31 in BPSK mode, and MFSK16 on a daily revolving schedule.

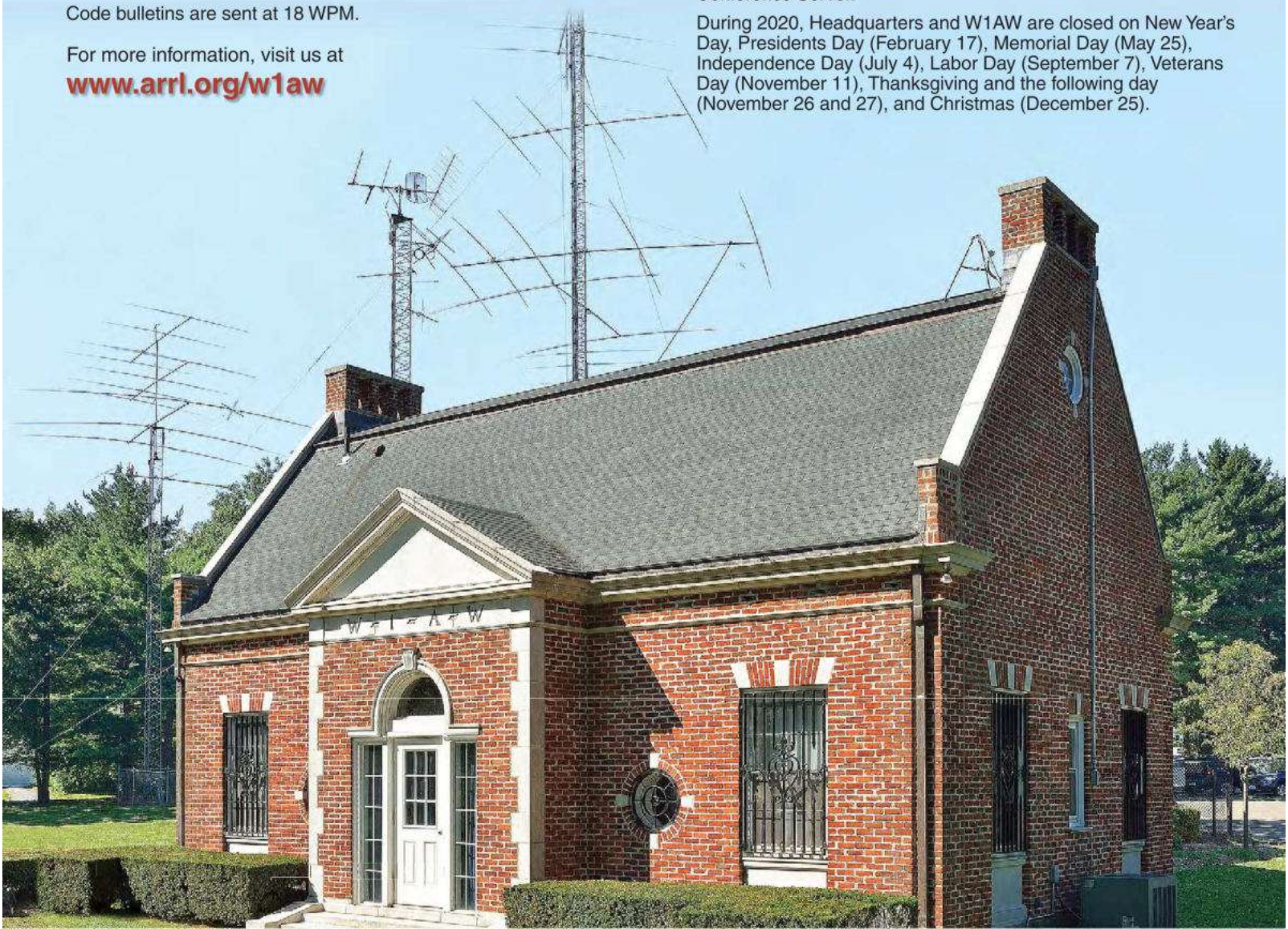
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ Voice transmissions: Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59, 50.350, and 147.555 MHz. Voice transmissions on 7.290 MHz are in AM double sideband, full carrier.

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM Monday through Friday. FCC-licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

W1AW code practice and CW/digital/phone bulletin transmission audio is also available real-time via the *EchoLink Conference Server* W1AWBDCT. The conference server runs concurrently with the regularly scheduled station transmissions. The W1AW Qualifying Run texts can also be copied via the EchoLink Conference Server.

During 2020, Headquarters and W1AW are closed on New Year's Day, Presidents Day (February 17), Memorial Day (May 25), Independence Day (July 4), Labor Day (September 7), Veterans Day (November 11), Thanksgiving and the following day (November 26 and 27), and Christmas (December 25).



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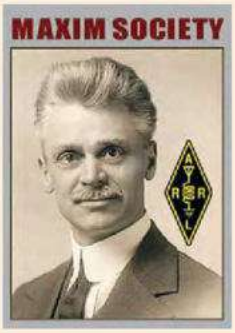

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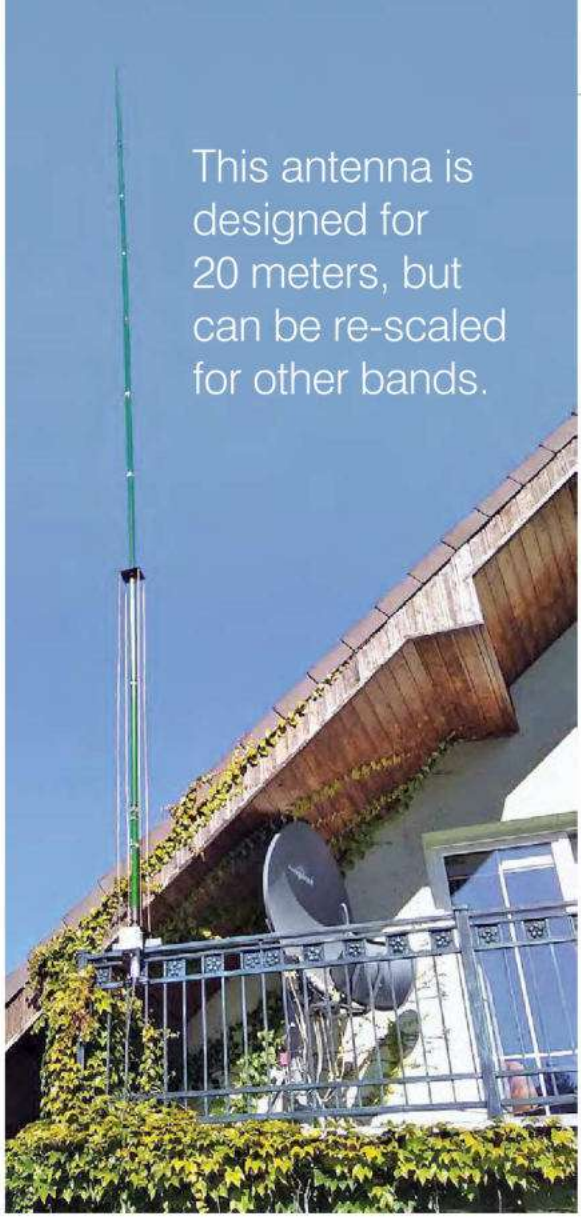

A Vertical End-Fed Dipole with a Folded Stub

Jacek Pawlowski, SP3L

If you don't have a system of radials buried in the ground, or if you want to place a vertical dipole on a balcony (see the lead photo) or roof where an RF ground is not available, the solution could be an end-fed Zepp antenna — a century-old design. The Zepp is an end-fed half-wavelength ($\lambda/2$) dipole in which a quarter-wave stub made of a ladder line is connected to the dipole end in order to transform the very high antenna impedance to a low impedance. A classic half-wavelength Zepp with a horizontal quarter-wavelength stub is shown in Figure 1. The stub does not radiate.

Despite its advantages, the classic end-fed Zepp is not often used on HF bands. This is probably because of the length of its $\lambda/4$ stub. So, let's revisit and modify the venerable Zepp to make it more attractive.

Folded-Stub Concept

My modification of the end-fed Zepp reduces the space needed for the antenna installation while improving its performance. To start, I folded the stub in half and rotated it to the vertical position (see Figure 2). This brought the feed point close to the bottom end of the $\lambda/2$ radiator.

The overall antenna height is $\lambda/2$ and the folded rotated stub itself is now $\lambda/8$ high. The antenna has a very small footprint because the stub is located close to the radiator. Total radiation from the stub is still almost zero. The antenna radiates the same as a center-fed dipole.

Free-space simulations reveal a gain of 2.13 dBi, feed point impedance Z_0 of 71 Ω, and a bandwidth 66% that of the center-fed dipole.

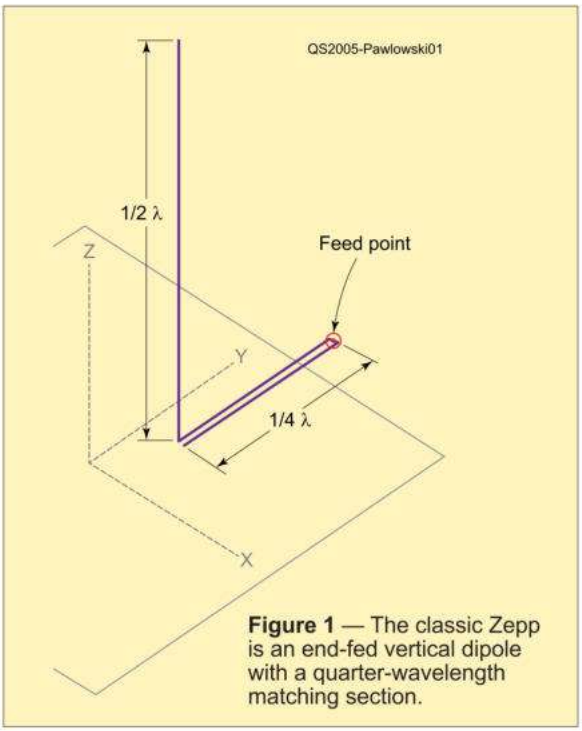

Figure 1 — The classic Zepp is an end-fed vertical dipole with a quarter-wavelength matching section.

Hamspeak

Stub

A length of transmission line connected at just one end. Stubs can function as capacitors, inductors, or resonant circuits, depending on their electrical length and whether they are open or short circuits at the free end of the stub.

Antenna Design

I built the folded-stub vertical Zepp for the 20-meter band. I started with a 10.3-meter-long fiberglass fishing pole for the main radiator support. Next, I chose a distance of 13 centimeters between the stub legs, so I used 15 × 15 centimeter square isolating plates for the stub wire supports (see Figure 3). Simulations predicted that I would need a 2.63-meter-long stub if it were made of 2-millimeter-diameter bare copper wires. The λ/2 radiator should be about 10.3 meters long. However, I needed about 30 centimeters at the bottom of the fiberglass pole to create a mount for the antenna.

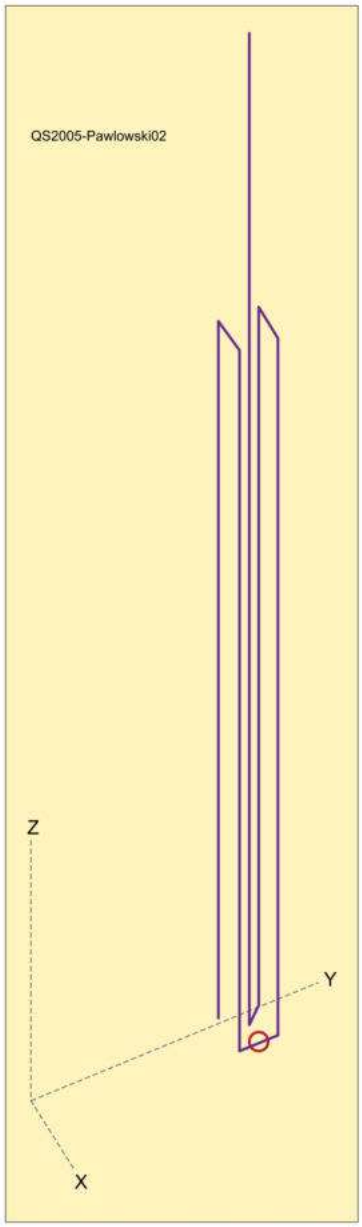

Figure 2 — The lower section of the antenna is a folded stub that is rotated to the vertical orientation.

I used insulated wire to make the radiator about 3 to 5% shorter than a bare wire, so 10 meters should be enough for a λ/2 length radiator. It looked like my 10.3-meter-long fishing pole was well-suited for a 20-meter-band end-fed dipole.

Figure 4 shows the initial antenna design dimensions.

Construction

Because the stub was short, I could use just two polyamide (PA) plates, 15 × 15 × ½ centimeters each, to keep the stub wires positioned correctly. The PA material has good mechanical and thermal properties. Moreover, black PA has increased resistance to UV radiation. PA material is hygroscopic, so if it's subjected to rain, it soaks up water, degrading its isolating and dielectric properties. However, the 13 centimeters between the stub wires seemed to be more than enough to guarantee there would be no voltage breakdown or significant leakage current due to a wet PA plate.

After drilling the holes for the pole and the stub wires, I attached stainless-steel standoff pipe clamps to the plates using aluminum angle brackets. I riveted the angles to the plates, but you can use bolts and nuts as well (see Figure 3).

I used a UV-resistant polycarbonate box (see Figure 5) to house the matching network, which was screwed to the bottom stub supporting the PA plate.

Figure 3 — Details of the mounting plate and the railing mount of the antenna.

The matching network circuit consists of TR1 (a 1:1.56 voltage un-un) and TR2 (a 1:1 current balun/common-mode choke). TR1 was wound with five enameled wires, ½ millimeter in diameter, connected as shown in Figure 6. TR1 has five turns. Choke TR2 was wound with 12 turns of a thin 75 Ω RG-175 coax. Each transformer uses an FT140-61 toroid ferrite core. For transmitter output powers greater than 200 W, consider using larger cores (like FT240-61) and thicker coax for the choke. Figure 5 shows the interior of the matching network box.

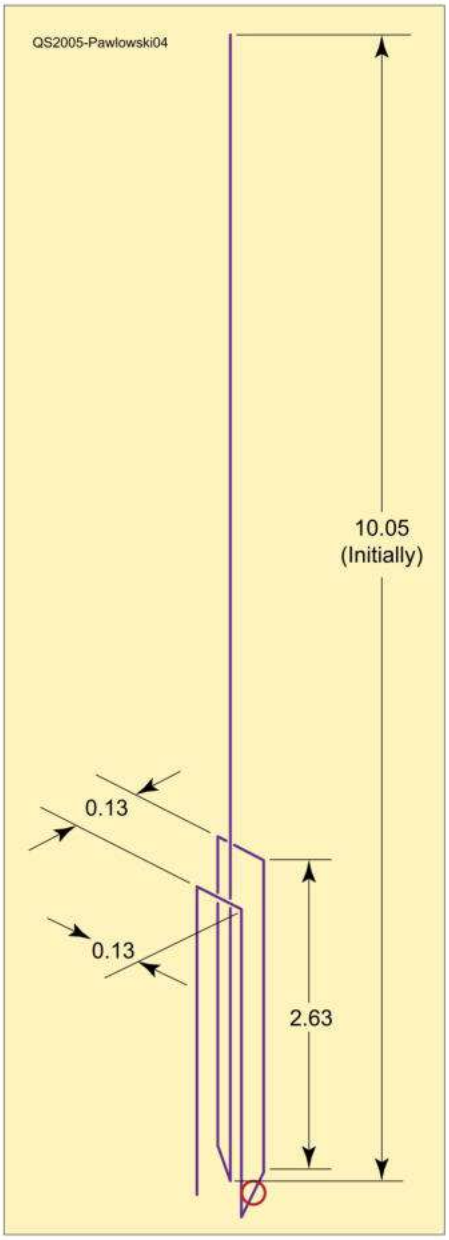

Figure 4 — The initial design of the vertical dipole with its folded stub shows the feed point at the bottom. All dimensions are in meters. The half-wavelength-long radiator is made from insulated copper wire.

I fashioned the railing mount from two aluminum angle brackets riveted to each other and attached to the antenna mast with a **U** bolt (see Figure 3). To prevent damage to the fiberglass pole, I slid a 30-centimeter-long, 50-millimeter outer diameter aluminum tube over the bottom section of the pole.

Fishing pole sections have rather thin walls, unlike the poles built as antenna masts. I strengthened them at the junctions using electrical tape and hose clamps, as seen in Figure 7.

Tuning

I tuned the folded-stub Zepp in two steps: first the stub itself, then the complete antenna. When the pole was extended to about 3 meters (three sections), I attached the stub supporting plates, the balun box, and the stub wires. I initially made the stub a little longer than the computer model predicted. I attached this half-finished antenna to a short provisional mast and

Safety Warning

No matter what kind of antenna you apply the folded stub to, you should remember that very high RF voltages will be present at the ends of the stub and at the end of the radiator when you transmit. Be sure that people and animals won't be able to touch the ends of the stub.

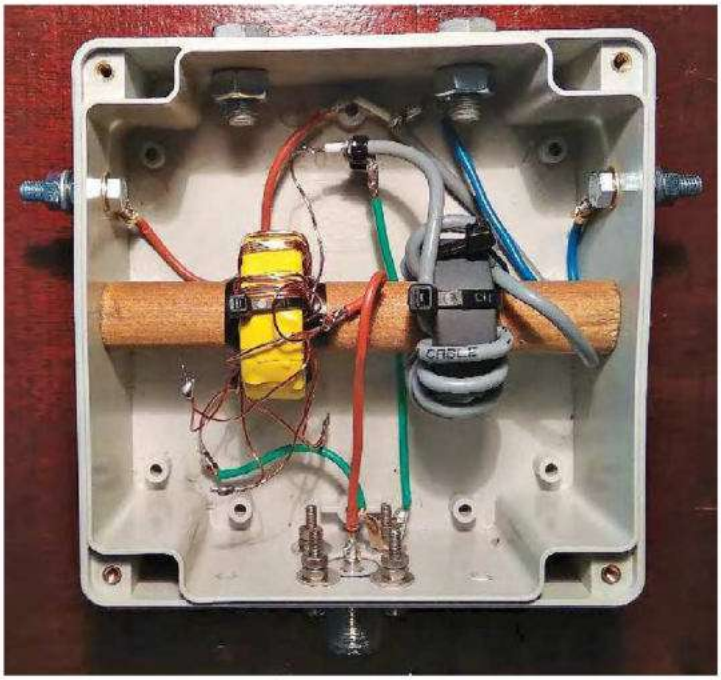

Figure 5 — The matching network box houses transformer TR1 and common-mode choke TR2. The core for TR1 is taped with yellow electrical tape.

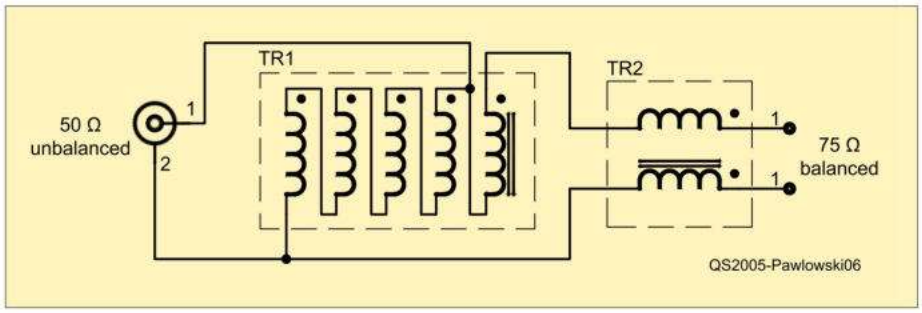

Figure 6 — The matching network consists of a 1:1.56 voltage transformer (TR1) and a 1:1 common-mode choke (TR2).

Figure 7 — Secure the junction of two sections of the antenna mast using electrical tape and hose clamps.

connected an antenna analyzer to the balun box through a short piece of coax.

When trimming the stub without a half-wavelength radiator, you should switch the antenna analyzer to read R and X or $|Z|$ and phase, and find a frequency at which it resonates ($X = 0$, or phase = 0°). The stub should be trimmed to a length at which the resonance frequency lies within the amateur band, ideally right in its center. In the prototype antenna, this happened almost exactly at the predicted length of 2.63 meters.

With the stub tuned, I extended the mast to its ultimate length and attached it to an insulated stranded copper wire to create a half-wavelength radiator. This time, the antenna analyzer was switched to read SWR. To my surprise, I had to significantly trim the radiator wire during antenna tuning from the initial 10.05 meters to 9.13 meters. I then remembered that I had already encountered a very similar case when using this particular fiberglass pole. Evidently, placing a wire very close to a thick fiberglass pole was like using an insulated wire with a very thick insulation. I needed to trim the radiator length by 11%. I do not know if this shortening effect is typical for every mast made of fiberglass, but that was the case for mine.

Testing the Antenna

Once I trimmed the antenna on a provisional mast about 1 meter above the ground, I lifted it to its final operating position 4 meters above ground on the balcony railing (see the lead photo). Elevating this dipole improves its low-angle radiation performance. The resonant frequency changed very little in the new position when measured with a 2-meter-long coax cable. When I attached a 30-meter-long cable connecting the antenna with my transceiver, the SWR minimum did not shift, indicating that there was no significant common-mode current on the feed line. The measured SWR stays under 1.5:1 across the entire 20-meter band.

On the Air with the Folded-Stub Vertical Antenna

Finally, it was time to compare performance of the folded-stub vertical dipole (FSVD) with another antenna I had in my garden: the GP-7DX (GP) by Krzysztof Sobon, SP7GIQ, which is somewhat similar to the AV-640 made by Hy-Gain.

I compared both my FSVD and GP antennas at distant stations, listening to my signal via *WebSDR* receivers. From my location in Poland, I found the FSVD equal to the GP in Washington, DC, slightly better (+2 dB) in Chelyabinsk, Russia, and slightly worse (–1 dB) in Andorra, Europe. In many cases, I could not hear any difference.

The main advantage of the FSVD over the GP is its very small footprint and ease of installation. Only a single mounting point is required — a mast or a railing — and minimum of room around it. Of course, the antenna is higher than a GP, and its maximum radiation occurs not at the bottom but at the center of the radiator, which is helpful.

Jacek Pawlowski, SP3L, is an electronics engineer (MSc). He started his career as an electronic designer, mainly in the test and measurement area. After 15 years as a circuit/PCB designer, he switched to a management career path. He's been the research and development project and department manager at a few companies since then.

Jacek first became interested in radio when he was in a primary school in the early 1970s. From 1978 – 1999, he was active as SP3LFV. In 2014, he became active again under his current call sign and got interested in antenna design. You can reach Jacek at **sp3l@wp.pl**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

A Raspberry Pi USB Serial Server

This method extends a USB connection to almost anywhere and is perfect for remote applications.

Mark Erbaugh, N8ME

A Raspberry Pi can be used to stream serial port data to and from a USB device over a local network, allowing you to plug a USB-based device into the Pi rather than a computer. This allows the USB device to be accessed from multiple computers, which comes in handy for remote operating.

Getting Started

Linux on the Raspberry Pi recognizes the common USB/serial chipsets and automatically configures and installs a USB serial device when the device is plugged into a USB port. These devices show up as TTY devices in the **/dev** directory. Before plugging the device into the Pi, use the command line to get a directory listing, using **ls/dev/tty***. Plug the device in and repeat the listing. If the device was properly configured, there will be a new device.

With the *ser2net* package from the Linux repository, a Raspberry Pi can convert the data stream to and from this device to a TCP stream over the network. Install *ser-2net* from the command line, **sudo apt-get install ser2net**. The installation creates a configuration file, **/etc/ser2net.conf**, which has comments describing how to configure your devices. You configure a device by adding a line to the configuration file, similar to:

6000:raw:600:/dev/ttyACM0:115200 8DATABITS NONE 1STOPBIT

6000 is the TCP port to be used. If you have multiple devices, each should use a different TCP port. **raw** indicates the type of connection. **600** is the timeout.

Helpful Definitions

Raspberry Pi: A series of small, single-board computers developed in the UK by the Raspberry Pi Foundation to promote teaching of basic computer science.

Linux: A family of open-source Unix-like operating systems based on the Linux operating system kernel, first released in 1991 by Linus Torvalds, and typically packaged in a Linux distribution.

Ser2net: The serial-to-network proxy that allows telnet and TCP sessions to be established with a unit's serial ports.

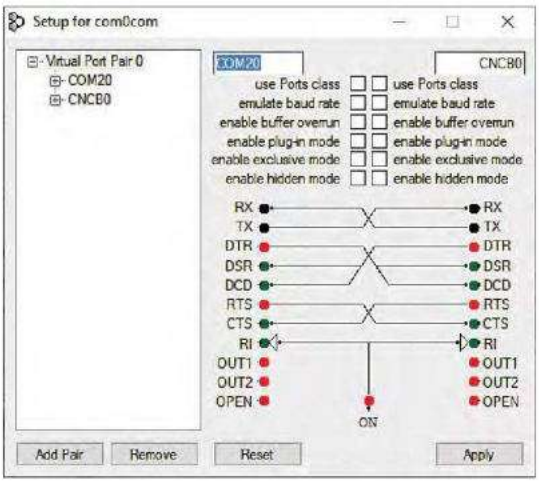

Figure 1 — The setup of the *com0com* virtual serial port.

/dev/ttyACM0 is the device name found above. The remainder of the parameters are the serial port communication parameters. Once you have edited ser2net.conf, restart the ser2net service with **sudo/etc/init.d/ser2net restart**, or just reboot the Pi.

Using a Virtual Serial Port

The control programs for most devices aren't capable of using a TCP stream directly. They have to be connected to a COM port. Fortunately, the *com0com* virtual serial port project provides this capability, with its *com2tcp* utility. Download the *com0com* installer from SourceForge (**https://sourceforge.net**) as well as the *com2tcp* utility from the project's **FILES** section.

Run the installer included in the *com0com* download. The default install creates a com0com folder in the **PROGRAM FILES (X86)** folder. **SETUPG.EXE** and **SETUPC.EXE** are respectively graphical and command-line programs to configure virtual serial port pairs.

com0com is just one of several virtual serial port utilities. A virtual serial port pair is similar to two physical serial ports connected with a cable. Data that goes in one port comes out the other and vice versa.

Launch **SETUPG.EXE**. Click the **ADD PAIR** button (see Figure 1). A pair of ports, CNCA0 and CNCB0, is created. Click in the edit box at the top right of the screen and rename **CNCA0** to **COM##** where **##** is a number that represents an unused com port (i.e. COM20). Click the **APPLY** button. Click the **X** at the top right to close the setup program.

Converting the Data

com2tcp can be used to convert the TCP data from the Raspberry Pi back to a serial port. It is distributed as source code only, so it will have to be compiled. Open a command window and run something similar to:

com2tcp --baud 115200 --ignore-dsr \\.\CNCB0 raspberrypi 6000

---baud sets the baud rate, **--ignore-dsr** tells the interface to ignore hardware DSR, **\\.\CNCB0** is the virtual serial port to use, and **raspberrypi** is the network location Raspberry Pi. You can also use the TCP/IP address. **6000** is the TCP port configured in *ser2net*.

Launch the control program and configure it to talk to the other virtual serial port in the pair (i.e. COM20). Note that the *com2tcp* program must remain running. To simplify usage, create a batch file that runs *com2tcp* and launches the control program using the **START** command.

These steps should provide even the novice Raspberri Pi user a working USB serial server. Feel free to contact me if you have questions.

Mark Erbaugh N8ME, an ARRL Life and Diamond Club Member, has been licensed since 1982. He has served on the Board of Directors of the Dayton Amateur Radio Association (DARA) and was the License Exams Chair for the Dayton Hamvention®. For several years, Mark was the 8th Area Region Coordinator for the Laurel Volunteer Examiner Coordinator (VEC) and served three terms as the Vice Chair of the National Conference of Volunteer Examiner Coordinators (NCVEC). Mark is currently the Secretary of the Madison County Ohio ARC and the ARES Emergency Coordinator for Madison County. You can contact Mark at **n8me@arrl.net**.

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Mark J. Wilson, K1RO, k1ro@arrl.org

Product Review

ACOM 1200S 160 – 6 Meter Linear Amplifier

Bottom Line

The compact, attractive ACOM 1200S delivers a full kilowatt output on all modes with no duty-cycle limitations and will satisfy most operating needs. If paired with a high-power auto-tuner, the combination will deliver full auto-tune, wide-band HF and 6-meter performance.

Reviewed by Ward Silver, N0AX
n0ax@arrl.org

Established and new manufacturers have been introducing solid-state RF power amplifiers for HF and 6 meters with output power up to 1,500 W. The ACOM 1200S is a 1 kW output example of these new amps. (Specifications are listed in Table 1.)

Recently introduced RF transistors with built-in protection operate at 50 V or higher (the 1200S uses a single 1400-W BLF188XR LDMOS device). This reduces power supply current requirements and also makes it possible to reduce IMD (intermodulation) products generated by the transistor nonlinearities.

Regarding reliability, as a friend in the MOSFET business once said, "RF power transistors are always one-half cycle away from destruction!" The new generation of rugged transistors can withstand very high voltage standing-wave ratio (VSWR) in pulsed service at full power, but protective circuitry is still needed for the continuous duty typical of amateur use, particularly digital modes. The amplifiers are designed to reduce power output at high SWR and take themselves offline if there is too much reflected power or transistor current.

Table 1
ACOM 1200S, serial number 190173, firmware v1.8

Manufacturer's Specifications	Measured in ARRL Lab
Frequency range: All amateur frequencies in the range of 1.8 to 29.7 MHz, 50 to 54 MHz.	Tested on 160, 80, 40, 30, 20, 17, 15, 12, 10, 6 meters.*
Primary power requirements: 100 to 240 V ac.	As specified. Tested with 240 V ac supply.
Power output: 1,000 W ± 0.5 dB PEP or continuous carrier with continuous carrier with no mode limitations (with 240 V ac supply). 500 W with <150 V ac supply.	As specified.
Driving power required: Typically 40 W for 1,000 W RF output.	Drive level for 1,000 W output: 7 MHz, 28 W; 14 MHz, 49 W; 18.1 MHz, 66 W; 21 MHz, 59 W; 24.9 MHz, 49 W; 28 MHz, 57 W; 50 MHz, 29 W. See Figure A.
Spurious and harmonic suppression: HF: >60 dB, 65 dB typical.	HF: 63 dB typical, 58 dB worst case band (12 meters). 50 MHz, 62 dB. Meets FCC requirements.
Third-order intermodulation distortion (IMD): >31 dB below rated PEP.	14 MHz, 3rd/5th/7th/9th: At 1,000 W PEP: –34/–33/–47/–64 dB. At 500 W PEP: –33/–41/–54/–62 dB.
Keying time: Not specified.	Unkey to key, 15.2 ms; key to unkey, 20 ms.
Size (height, width, depth): 6.7 × 17 × 14.6 inches; weight, 32 pounds.	

*Reminder: US amateurs must observe a limit of 200 W PEP output on the 30-meter band.

Figure A — ACOM 1200S RF input versus RF output.

The amplifiers are discussed as being "no-tune," but band-pass filters are required to meet FCC regulations for spurious emissions. The amplifiers are really only "no-tune" within a single band, in the sense of not needing to adjust an impedance matching network inside the amplifier — there are no **TUNE** and **LOAD** controls but an appropriate output filter must be switched in for each band. With a CAT interface to the transceiver to control band selection, or using the built-in frequency counter to sense the incoming RF, you can switch bands from the front panel of the radio and go.

Installation

The 1200S weighs only 32 pounds — I have had tube amplifiers with heavier power transformers. The footprint on the tabletop is 14.6 inches wide by 16.8 inches deep. The amplifier stands 6.7 inches high, so it is of the same general size as a large transceiver. Combined with a high-efficiency, internal switch-mode power supply, this is truly a "desktop kilowatt." The amplifier can operate from 93 to 265 V ac at 50 or 60 Hz without any reconfiguration of the input power connections required. You'll have to provide your own power cord to suit the local power system. If operated from 120 V ac, the maximum power output is reduced to 500 W.

In my station, I simply swapped the 1200S for my kilowatt tube amplifier, driven by a TS-590S transceiver. The physical switch was easy because the 1200S is smaller and lighter. As far as radio cabling goes, my existing amplifier keying cable was a direct match for the amp's phono jack and the RF connections consist of one RF input and one RF output (see Figure 1). The amplifier keying line (**KEY IN**) connected directly to the TS-590S as a standard ground-to-key output. There is no ALC input on the 1200S, so that cable was left disconnected.

There is also a **KEY OUT** output from the 1200S that can be used as an "amplifier ready" line, but I used the transmit-delay function of the TS-590S to hold off the RF for the required 15 milliseconds after the amplifier keying relay closes. For transceivers with a transmit inhibit input, the **KEY OUT** signal can be used to prevent premature transmissions. (If the amplifier detects the RF too early, it changes to the **STANDBY** mode and displays a fault message.) I used the keying relay in the TS-590S to control the amplifier. Because I

Figure 1 — The ACOM 1200S rear panel.

was operating semi-break-in, that was not a problem (the 1200S does not support in full break-in, or QSK, operation).

Configuration

Getting the amplifier set up is straightforward. Once the power is applied and the red LED on the front-panel power switch is on, hold down the power switch until the amp sends **TEST** in Morse code audio. (The Morse annunciations are a nice touch, especially to the sight-impaired.) Note that you have to turn on the back-panel power switch for the front-panel power switch to work. If the red LED power indicator isn't on, the front-panel switch doesn't turn the unit on.

The boot-up sequence for the amplifier seems to take a little time when the amplifier is new. Just be patient, and when the user screen lights up a few seconds later, you're ready to configure the amplifier's settings. After you've set everything up the first time, the power-on sequence is faster. When the amp is ready to go, it sends an **R** character and waits for the operator in **STANDBY** mode.

Figure 2 — The ACOM 1200S offers a number of menus for configuring and using the amplifier.

Figure 2 shows the **MENU SELECTION** screen. The next item of business is to select the **CAT SETTINGS** menu and follow the steps described in the manual to get the CAT interface configured. (Manual and frequency-sensing band-switching is also supported.) In the "CAT Settings Menu" section of the manual, a table shows which options to select for the type of interface needed — **RS-232**, **TTL**, **BCD**, or **VOLTAGE**. Another table shows the proper options for various models of radios from Icom, Elecraft, Kenwood, and Yaesu. You then select the data rate and polling rate to match the radio's settings and plug in the cable. The TS-590S and the 1200S were happily communicating via RS-232 right away. At the same time, I had the TS-590S interfaced via its USB port with a PC running *N1MM+ Logger* software without any apparent problems. If you want to use an Icom CI-V interface, you'll have to build or buy a cable with the ⅛-inch mono phone plug on one end for the radio and a DB-9 on the other end for the amplifier. The amp is designed for use in a remote-control station, with power on/off controlled through the **REMOTE** interface or the **CAT/AUX** interface.

If you choose not to use the amplifier's CAT interface, it can be turned off, and the amp's internal frequency counter will determine the incoming RF frequency and switch the amplifier's band accordingly. A single 100-millisecond dit, a short pulse of carrier, or a voice syllable or two is long enough for the amplifier to switch to the correct band. I have never been comfortable intentionally transmitting into a mistuned amplifier for any length of time, but it is nice to know that I have that option with the 1200S. Another option is to use the **BAND UP/BAND DOWN** switch on the front panel. I noticed that the band selection does not wrap around from 160 to 6 or from 6 to 160 — that's a good thing in the middle of a contest.

After the radio and amplifier are talking to each other, the manual leads you through a series of careful step-by-step checks to be sure the receiving and transmitting functions are working and hooked up as you expect. The tests ensure that signals get to the radio's receiver when the amplifier is in **STANDBY** or

Figure 3 — A typical display during operation on 20 meters. All important parameters are available at a glance.

not being keyed. Then you check the transmit functions, one by one. Finally, a low level of RF is applied, and you can check out the transmit functions using a dummy load. Only then should you try driving the amp to full power. It's easy to misconnect a new piece of equipment, so a cautious approach is helpful. The same checkout process will also be helpful in isolating any problems during troubleshooting.

There is a full **TEST** menu that includes running the fan at different speeds and making sure any external relay- or switch-based BCD band-select interface is working. An **AMPLIFIER MEASUREMENTS** screen displays the value of major parameters, such as input and output power, SWR, transistor current and bias, and amplifier temperature. The amplifier is well-instrumented with the necessary data available to the user.

Performance

I gave the amp an extended test during the 2020 ARRL DX CW Contest in a Multioperator-Two Transmitter (Multi-Two) operation from my station. The amplifier was powered from 240 V ac and used pretty much continuously at full power for 48 hours without incident. I kept a sharp eye on the **PA TEMPERATURE** meter, and it never went into the red zone, nor did the fan have to kick into high gear. Fan noise was minimal during the contest — no louder than my tube amps. No RFI issues were experienced with the CAT connection to the transceiver for the entire contest. Figure 3 shows the LCD during typical operation.

The amplifier has 14 dB of gain, so not much power is necessary for full output. Typically, 25 to 40 W was enough to result in RF output near full power on any of the bands. The low drive requirements make this amp an excellent partner for the low-power SDR transceivers starting to appear. A 10 to 20 W transceiver can drive this amp to several hundred watts of output, where it will be coasting along. That's just right for operation using one of the *WSJT-X* digital modes, PSK31, or RTTY. At reduced power, the amplifier will run cool and should be a reliable performer in a remote station, as well.

Typical of solid-state amplifiers, the 1200S is sensitive to SWR. It is specified at SWR less than 2:1, preferably 1.5:1 or less. My 40-meter, two-element beam is tuned for minimum SWR near 7.175 MHz and has an SWR of about 2.2:1 at 7.020 MHz. My tube amps are unfazed by this and tune up into the antenna anywhere in the band without complaint. The 1200S, however, was unable to develop more than about 500 W of output at the low end of 40 meters without faulting and going into standby. Luckily, I had a 1 kW antenna tuner available and put that in-line for the 40-meter beam. The antenna tuner lowered the SWR to 1:1 at 7.050 MHz, and there were no more faults due to SWR. When ACOM says 2:1, they mean it — you won't get full output at or above an SWR of 2:1.

If your antenna system SWR is higher than 1.5:1 where you intend to operate, you should retune the antennas. If that's not feasible and SWR is higher, you'll have to use an antenna tuner rated for at least 1 kW. To utilize the amplifier's full flexibility, you'll need an automatic tuner, such as the recommended ACOM 04AT. The external tuners do add expense to the overall system, but the combination of the 1200S and 04AT gets high marks from other users, as reported online.

Caveats

On most of the bands, we took it easy and ran the amp with 25 to 35 W input, so the RF output stayed somewhat lower than full output. You can create problems for yourself through excess drive, however. Some transceivers can set a different power level for each band, but the TS-590S cannot. This caused a problem when we were operating on 40 meters after using the amp all night on the low bands at full power. I got a report of bad key clicks and discovered that drive was still set to the 80-meter power level — more than needed on 40 meters. (The TS-590S CW keying rise time was set to the maximum of 6 milliseconds.)

The amp wasn't faulting, but it was clearly being pushed.

Reducing drive cleared up the clicking, so after the contest, I checked it out more thoroughly. To make a long story short, without an ALC signal from the amp back to the radio, it's easy to push the amp pretty hard. The TS-590S transceivers also have a well-known leading-edge transient on the output waveform that shoots up to full power before the radio's own ALC can bring power back down to the required level. The combination of the transient and higher drive than needed was the likely culprit behind a bad signal. ALC-caused transients on other radios may cause the same problem. With the tube amps, the TS-590S runs at nearly full power output, so the transient was never an issue. (Kenwood fixed this transient in late-production TS-590S radios and in the TS-590SG. They also offered a free modification for owners of early radios, but my radio has not yet been modified.)

I learned that it's best to watch your drive level with high-gain solid-state amplifiers in general to avoid both overdriving the amp and possibly creating spurious emissions. This particular problem was a combination of the operator (me) not checking drive level and a quirk of my TS-590S (the overshoot). It wasn't a particular deficiency of the amplifier but an example of what you have to be careful about with high-gain solid-state amps.

On 6 meters, the amp performs very nicely. I hooked it up to my venerable IC-7000 transceiver, which is my go-to radio for the *WSJT-X* modes, primarily FT8 and MSK144. The IC-7000's amp keying line is available on the 13-pin ACC socket, so it was easy to get that working and the necessary CAT cable was ordered with the amplifier. I was able to adjust the key-to-RF-output delay in the *WSJT-X* software, choosing 200 milliseconds for plenty of safety cushion beyond the 15-millisecond minimum requirement.

Because FT8 and MSK144 require long transmissions, I was interested to see whether the amp would run hot. Running 10 W from the transceiver on 50.313 and 50.260 MHz produced 370 to 400 W output. Because I was powering the amplifier from 120 V ac at the time, this was about 80% rated power.

PA TEMPERATURE is displayed on the front-panel screen as both a numeric value (in degrees Celsius or Fahrenheit) and as a bar graph. During the long transmissions, you can clearly see the temperature going up several degrees. The fan speed increases one level at 50 °C but is still very quiet. The long transmit periods never pushed temperature higher than 55 °C, and that was after extended periods of CQing. If I were going to do an RTTY contest at 1 kW output, I would expect much more heat from the amplifier, though.

User Interface

As I mentioned earlier, the amp doesn't just "beep" when a function is performed or a message displayed. It sends you a Morse letter or two. When the amp powers up, you hear **TEST**, then **R** when it is ready for operation, and when you turn it off, **AR**. If a fault condition is detected, the letter **F** is sent. So even if you never operate CW, you'll learn a little bit just by using the amp.

Using intelligent annunciations is a nice touch. Every appliance and piece of equipment beeps, but very few use the controller to actually communicate with the user. I'd like to see more of that — like maybe sending **AS** when going into **STANDBY** mode.

The LCD, though not a touchscreen, is very high quality and colorful. Brightness is adjustable and the default setting was fine at normal room lighting levels. There is a lot of information on the display, but it is not that big. The designers probably assumed the amplifier will be close to and in front of the operator. Still, the labels for the selected band and the bar graphs are bright and easy to read, even off to the side of your visual field.

As shown in Figure 3, the status indicators (**OPERATE/STANDBY**, **TX/RX**, **CAT STATUS**, and **REMOTE**) are very small — about ⅛-inch square — and don't show up well. With all that display real estate to work with, there's no reason not to make the indicators much larger so the operator is more likely to notice a change in status.

The overall design of the amplifier is very sleek, reminiscent of consumer audio equipment. The LCD is nicely placed and the black switches match the panel exactly. This is a nice-looking piece of radio gear.

User Manual

The user manual is brief but complete as far as setup and operating directions go. There does not appear to be a service manual, so there is no schematic of the amplifier available. (Check the **DOWNLOADS** tab on the ACOM 1200S website for a copy of the manual, as well as the latest firmware.)

The manual's English is a bit strained in places, but with careful reading and reference to the controls and screens, it gets the job done. All of the screens, controls, and drawings are accurate and clear.

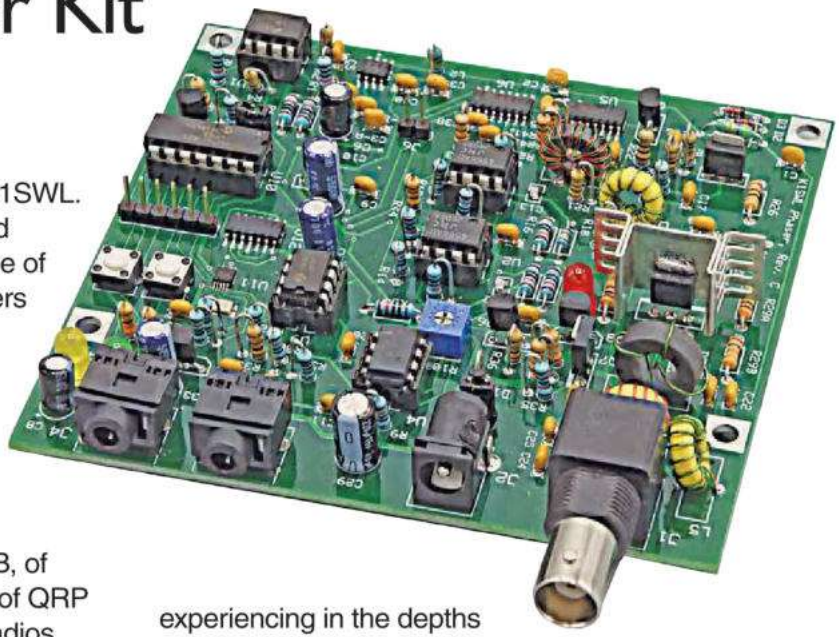
Summary

After several years of anticipating kilowatt-plus solid-state amplifiers, the manufacturers have delivered. The full-kilowatt output of the 1200S is quite enough for most operating needs at a reasonable price. ACOM has done a good job with this compact amplifier. The designers have paid attention to what amateurs need in their stations, including remote control. If paired with an auto-tuner, the combination will deliver full auto-tune, wide-band HF and 6-meter performance.

Manufacturer: ACOM OOD, Bozhurishte, Bulgaria; **www.acom-bg.com**. Available from several US dealers. Price: $3,700.

Midnight Design Solutions Phaser Digital Mode Transceiver Kit

Reviewed by Steve Ford, WB8IMY
wb8imy@arrl.org



Many of you may remember Dave Benson, K1SWL. He was the designer and entrepreneur behind Small Wonder Labs, the manufacturer of some of the most popular low-power (QRP) transceivers ever created. Several years ago, Dave decided that it was time to retire and close his business, much to the disappointment of many in the QRP community.

Well, he's back!

Dave has teamed with George Heron, N2APB, of Midnight Design Solutions, to offer a new set of QRP transceivers known as Phasers. These little radios are intended for use with the wildly popular FT8 digital mode. If any communication mode was tailor made for QRP, it is FT8. With just a few watts and an antenna, you can make contacts throughout the world, even during the marginal conditions we're experiencing in the depths of the solar minimum.

Bottom Line

The Phaser Digital Mode Transceiver offers a clever and inexpensive way to get on FT8 and other digital modes with a compact, dedicated QRP transceiver that is easily used in the field.

Phaser Flavors

Phaser transceivers are kits designed for operation on a single band. You have your choice of kits for 80, 40, 30, 20, or 17 meters. Dave designed each transceiver to be hard-coded for output on the FT8 frequency for each band. However, every transceiver is capable of operating on an alternate frequency that you can program yourself. If you want to operate another digital mode on the band, such as PSK31, for example, the frequency can be changed accordingly. So, while the Phasers are sold as "FT8 transceivers," they are actually multimode digital radios.

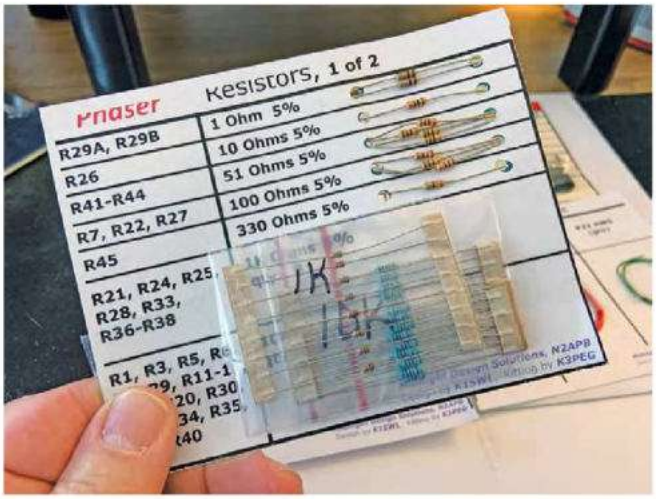


Figure 4 — Parts are mounted on labeled cards for easy identification.

Figure 5 — The Phaser enclosure front panel includes switches and LED indicators for selecting the standard FT8 frequency or alternate (user-programmed) frequency. (Note that the **TRANSMIT** indicator LED incorporated into the latest version could be mounted on the front panel as well.)

The Phaser transceiver generates about 4 W SSB output. Because virtually all FT8 operating takes place using upper sideband (USB) transmissions, the Phaser is hardwired for that mode.

Building the Phaser

For this review, I selected the 20-meter model and ordered the optional enclosure kit. The transceiver board is just 4.125 × 3.85 × 1.2 inches and includes seven preinstalled surface-mount components.

The through-hole parts are all mounted on labeled cards (see Figure 4). No more sorting and squinting as you try to read resistor color codes or barely legible numbers on disc capacitors. I've never seen such a straightforward approach to kit building, and Midnight Design Solutions should be congratulated on going the extra mile to ensure success. All you have to do is follow the instructions and pluck the parts you need from the cards.

The downloadable assembly manuals are thorough and colorful. Someone put a lot of effort into these documents. Once again, the obvious goal is to make the assembly steps as clear as possible. The manual even has a sense of humor. I had to chuckle upon seeing a visual example of an improperly wound toroid inductor. The caption beneath the image read: "Bad Toroid! (Bad, bad, toroid!)."

The assembly steps are divided into six groups of parts. When you complete a group, the manual instructs you to run some tests to make sure that the section of the transceiver you just built is functioning normally. I'm an experienced kit builder, so I chose to skip the tests. That's not the best approach for these

Figure 6 — The rear-panel connections for **AUDIO IN/OUT**, **ANTENNA**, and **POWER**.

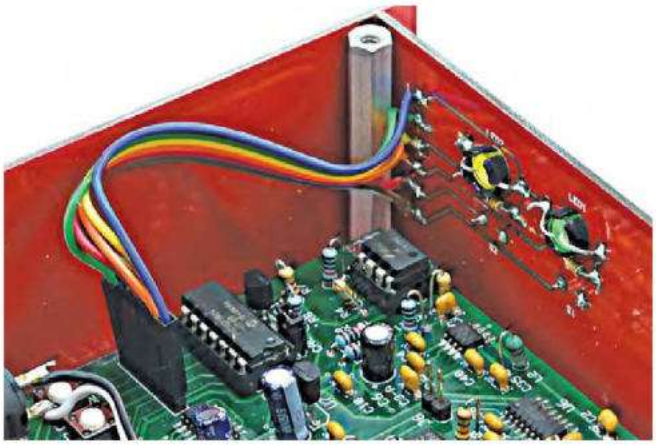


Figure 7 — The front-panel pushbutton switches and LEDs are soldered to traces on the back side of the panel and connected to the PC board with a ribbon cable.

Table 2
Phaser Digital Mode Transceiver Specifications

Frequency coverage:
Phaser-80 board, 3.573 MHz (FT8) and 3.578 MHz (JS8/Alt)
Phaser-40 board, 7.074 MHz (FT8) and 7.078 MHz (JS8/Alt)
Phaser-30 board, 10.136 MHz (FT8) and 10.130 MHz (JS8/Alt)
Phaser-20 board, 14.074 MHz (FT8) and 14.078 MHz (JS8/Alt)
Phaser-17 board, 18.100 MHz (FT8) and 18.104 MHz (JS8/Alt)
(For each band, the FT8 frequency is hard-coded and the Alternate frequency is set for JS8 but can be reprogrammed by the user for FT4, PSK, or other frequencies.

Transmitter operation: Phasing SSB, 4 W output (nominal).

Receiver minimum discernible signal (MDS): –109 dBm.

Power requirements: 12 V dc at 130 mA (receive) and 1 A (transmit).

Size (height, width, depth): 1.2 × 4.125 × 3.85 inches (PC board); 2 × 5 × 4.5 inches (enclosure).

Weight: 11 ounces with enclosure.

kits, though, as troubleshooting is much easier if you test as you go. The Phaser PC board is somewhat complex in terms of component density, so even with the excellent manual and the pre-labeling of parts, there is always an opportunity to make a mistake or the chance for a bad component. It's best to take your time and do the tests, just in case.

I needed about 6 hours to complete the kit PC board. Final testing is simple. You just connect the necessary audio cables to your computer, connect your antenna coax, apply transmit audio, and adjust a single potentiometer until the Phaser jumps to the transmit mode and starts generating RF output.

Note that the PC board shown here is the latest version. It incorporates a more robust bias switch than on the original and adds a current-limit function to cure an occasional issue with thermal overload when builders ran the transceiver at more than rated output. The new board also adds a transmit indicator LED to the board.

You can stop here and use the Phaser PC board without an enclosure. All connectors and controls are mounted on the board and are readily accessible. If you prefer your radio in a box, check out the optional enclosure kit, shown in Figures 5, 6, and 7. This kit uses interlocking fiberglass PC board panels designed to be soldered together along the inside mating edges, resulting in a sturdy case. The enclosure panels are finished with a smooth red solder mask, and the front and rear panels have silk-screened labels. It took me less than an hour to build the enclosure for my radio.

Phaser On the Air

You won't need an interface between your computer and the Phaser. The transceiver design includes a voice-operated switch (VOX) that keys the radio when sufficient transmit audio is present. I used my Phaser with a laptop computer that provided only a headphone output jack. That's the case with most modern laptops, but it doesn't present an impediment to using them with Phaser transceivers. All you need is an inexpensive outboard sound device that plugs into one of the laptop's USB ports. These devices are available for less than $20 from sources such as Amazon.

I fired up my *WSJT-X* software, configured it to use the external USB audio device, and selected "None" in the dropdown transceiver-selection menu. Phasers don't provide CAT connections, so I wanted to make sure the software wouldn't throw an error message after a futile attempt to communicate with a radio that wasn't there.

The *WSJT-X* waterfall display immediately came to life with FT8 signals and the software began decoding. On 20 meters, with my Icom IC-7300 transceiver and a vertical antenna, *WSJT-X* can decode FT8 signals at my station down to about –24 dB. With the Phaser, I was decoding signals as weak as –19 dB. Considering the fact that you're running QRP, this level of sensitivity is more than adequate. After all, extremely weak stations are unlikely to hear you anyway.

As usual, the FT8 watering hole on 20 meters was packed with signals. When you're operating at QRP power levels, it can be a challenge to be heard in such crowded conditions. I chose a relatively clear spot in the waterfall display and began calling CQ in the hope that someone would decode my 4 W signal.

After a couple of attempts, I finally received a response from a station on the opposite side of the continent. He gave me a –16 dB report, and I was pleased; not bad for a few watts and a vertical antenna. After finishing the contact, I checked the PSKReporter map (**pskreporter.info/pskmap.html**) and found that a number of other stations had reported receiving my signal as well.

I decided to reprogram the Phaser's frequency and give WSPR a try. Reprogramming the Phaser's frequency requires some practice; it isn't as simple as spinning a VFO knob.

There is a tiny pushbutton labeled **FT8**, which you must hold down while powering up the radio. When you release it, the **FT8** LED blinks twice to let you know you're in the frequency programming mode. Next, you have to use the **FT8** and **ALT** pushbuttons to enter the frequency by sending Morse code. The **FT8** button sends dits and the **ALT** button sends dahs. As you can imagine, the odds of making mistakes are very high. I needed several tries before I finally achieved success. No matter how badly you mess up, though, rest assured that the preprogrammed FT8 frequency will remain undisturbed.

An Investment in Fun

While I would not recommend the Phaser for your first kit-building experience, it should be well within the abilities of most hams, including beginners with some guidance. Several clubs have already purchased Phaser kits for group projects, which lend themselves well to the Phaser's thorough approach to building.

The Phaser manual is available for download from the Midnight Design Solutions website, so you can see what's involved in building and using it. The kit is well supported with a very active Chat With The Designers discussion group online at **groups.io/g/cwtd**.

Each kit costs just $55 and the optional enclosure is an additional $25. So, for $80, you can own a single-band transceiver that's perfect for portable operating. This review was written while we were waiting for Spring to arrive, but as soon as the weather warms and the COVID-19 "stay at home" rules loosen up, I'll grab my laptop and take my Phaser to a park. With just a simple portable antenna and a small battery to power the Phaser, I suspect I will be making plenty of contacts.

Manufacturer: Midnight Design Solutions, 205 Okema Trace, Loudon, TN 37774; **midnightdesign solutions.com/phaser**. Price (not including shipping): Phaser transceiver: $55; enclosure: $25.

Palstar DL2K High-Power Dummy Load

Reviewed by Mark Wilson, K1RO
k1ro@arrl.org

My first high-power dummy load was an old Heathkit Cantenna that used a big noninductive resistor immersed in mineral oil inside a 1-gallon paint can. It worked, but it was heavy, and somewhat messy. Modern technology brings us the Palstar DL2K dry dummy load, which uses noninductive solid-ceramic resistive elements cooled by a fan. This unit weighs just over 5 pounds and includes an accurate wattmeter.

The DL2K is rated to handle up to 2,000 W over a frequency range of dc to 100 MHz. The front panel has an RF wattmeter with 500 W and 2,500 W ranges.

The rear panel has an SO-239 connector for connecting the station transceiver and/or amplifier, and a 2.1-millimeter jack for power from the included 12 V wall cube or station power supply. Power is required for the meter illumination (the **LAMP** switch) and the

Bottom Line

The Palstar DL2K dry dummy load easily handles the legal limit of 1,500 W with low SWR on the 160- through 6-meter amateur bands. It's built into a sturdy and easy-to-use package, without the weight and mess of older, oil-cooled technology. Its built-in wattmeter is spot on.

Table 3
Palstar DL2K, serial number 32155

Power rating: 2,000 W for 1 minute, 400 W for 10 minutes.

Frequency range: dc to 100 MHz. See Figure 8.

Cooling: Fan (switched or thermostatically controlled).

Wattmeter power range: 0 – 500 W and 0 – 2,500 W.

Power requirements: 12 V dc at 144 mA (fan), 91 mA (lamp) and 230 mA (both).

Size (height, width, depth): 5.4 × 6.5 ×12.8 inches. Weight, 5.6 pounds.

internal fan. The fan is thermostatically controlled, and with the **FAN** switch in the center position, it turns on if the resistors reach an unspecified preset temperature. You can also set the front-panel **FAN** switch to **ON**, and the fan will run continuously as long as power is applied.

Lab Testing

The DL2K is rated to handle 2,000 W for 60 seconds and 400 W for 10 minutes. A derating chart in the manual can be used to calculate the maximum time limit for other power levels.

ARRL Lab Test Engineer Bob Allison, WB1GCM, tested the DL2K on 40 meters. First, he applied 125 W for 10 minutes. The SWR at the DL2K input started at 1.07:1, rising slightly to 1:1 after 3 minutes, where it remained for the duration of the test. The DL2K didn't get warm, and the fan did not turn on. Next, Bob applied 400 W for 10 minutes. The case was warm after this time period, but by no means hot. The SWR was 1.1:1 at the end of this test with the fan on.

After the DL2K cooled off, Bob applied 1,350 W, the maximum available at the time, for 65 seconds (per the derating chart). The case was somewhat warm at the end, with the fan on and hot air blowing out of the side vents. Again, the SWR remained around 1.1:1. The 3-inch fan blade produced average noise at a fairly high pitch.

The built-in analog power meter was very accurate. In the 500 W position, 125 W of power applied made the meter read 125 W, and at 400 W, it read 400 W. With the **POWER RANGE** switch set to 2,500 W, 1,350 W applied indicated 1,350 W on the meter.

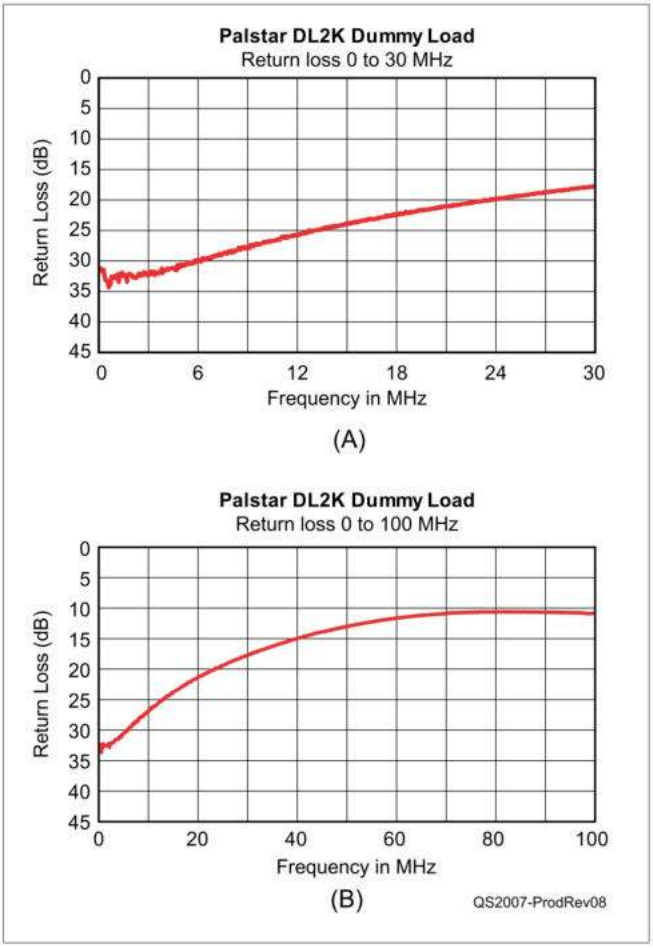


Figure 8 — Swept return loss of the Palstar DL2K over the range of 0 to 30 MHz (A) and 0 to 100 MHz (B). A return loss of 30 dB is the equivalent of an SWR of 1.065:1, 20 dB is an SWR of 1.22:1, and 10 dB is 1.93:1.

Note that the meter face reads 5,000 W maximum, but the DL2K is rated for a maximum of 2,000 W.

Figure 8A shows the swept return loss measured at the SO-239 jack on the rear of the DL2K over the range of 0 to 30 MHz. Figure 8B shows return loss up to 100 MHz. Return loss ranges from about 33 dB (SWR = 1.05:1) at 160 meters to about 18 dB (SWR = 1.3:1) at 10 meters. At 6 meters, return loss is about 13 dB (SWR = 1.6:1).

The Palstar DL2K is a well-built dummy load/wattmeter that will easily handle anything in the typical ham station. Just be sure to pay attention to the time limits for various power levels, as detailed in the manual.

Manufacturer: Palstar, Inc., 9676 N. Looney Rd., Piqua, OH 45356; **www.palstar.com**. Price: $399.95.

AlexTune Visual Tuning Indicator for Mag-Loop Antennas

Reviewed by Bob Allison, WB1GCM
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I've used an AlexLoop portable magnetic loop (mag-loop) antenna several times while on vacation. It is refreshing to operate in low-noise environments such as hilltops or parks. The mag-loop antenna is attractive for portable use, as it is easily deployed and mounted on a tripod.

Although the mag-loop works amazingly well for its size, the bandwidth of the antenna is very narrow, making tuning critical each time the operating frequency changes. A tuning knob on the antenna tuning unit adjusts for resonance. I turn this knob for the highest received background noise level to achieve a ballpark match with an SWR of about 2:1. An SWR analyzer or SWR meter can be used for more precise adjustments, or a transceiver's built-in automatic antenna tuner (ATU) can be used to reduce the SWR further.

Simple portable QRP (low-power) transceivers often have no ATU, SWR indicator, or relative power indicator to aid in tuning an antenna. Keeping in mind that simplicity in portable operations is desirable, AlexLoop creator Alexandre Grimberg, PY1AHD, has introduced the AlexTune, a tuning accessory for the AlexLoop. (For more information on the AlexLoop antenna, see the Short Takes review by Phil Salas, AD5X, in the November 2013 issue of *QST*.)

Using the AlexTune

The AlexTune is a simple, passive device used as a tuning indicator for the AlexLoop. It consists of a blue-white LED, mounted on a small (2 × 1 × ½ inch) plastic box that clamps over one of the PL-259 connectors used as part of the loop structure (see Figures 9 and 10). The AlexTune requires no electrical power; the LED lights from induced RF energy when transmitting.

Figure 9 — The AlexTune has a simple LED on the front and a clamp on the back that slips over a PL-259 connector on the AlexLoop element.

Tuning is made easy using the AlexTune. Just transmit a steady signal with a few watts of RF output and adjust the loop's tuning knob for maximum LED brightness on the AlexTune. I found the best match by using a range of output power that is just below full LED brightness. At that level, the peak brightness is more obvious, resulting in lowest SWR. I found it easiest to tune for lowest SWR using the RF power levels shown in Table 4.

Table 4
RF Power Needed to Light Tuning LED

Band (meters)	LED at Half Brightness	LED Near Full Brightness
40	2.0 W	3.7 W
30	1.3 W	2.7 W
20	1.1 W	2.0 W
17	1.0 W	1.7 W
15	0.9 W	1.6 W
12	0.8 W	1.5 W
10	0.7 W	1.4 W

Bottom Line

The AlexTune simplifies the adjustment process for the AlexLoop or other small magnetic loop antenna that uses coaxial cable with PL-259 connectors for the loop element.

Figure 10 — The AlexTune mounted on the author's AlexLoop antenna.

Once the best SWR is achieved, higher power can be applied to the AlexLoop, up to its maximum rating of 20 W PEP. I routinely achieved a measured SWR of 1.3:1 using only the AlexTune as a tuning aid. This is a handy accessory for the AlexLoop and may be useful with other similar antennas.

There is also a new version of the AlexLoop — the AlexLoop Premier with built-in AlexTune. This antenna integrates the AlexTune and LED into the matching unit.

Manufacturer: Alexandre Grimberg, PY1AHD, **www.alexloop.com**. Available in the United States from DX Engineering (**www.dxengineering.com**), Ham Radio Outlet (**www.hamradio.com**), and GigaParts (**www.gigaparts.com**). Price: AlexTune, $49.95; AlexLoop Premier with built-in AlexTune, $420.

Congratulations

April 2020
QST Cover Plaque Award Winner

Jim Millner WB2REM

Jim's article, "HD8M DXpedition to the Galapagos Islands," was about more than the team's 2019 operation on Santa Cruz Island in the Galapagos group. The article emphasized the need to preserve the unique flora and fauna of the islands. In fact, the DXpedition donated a portion of its QSL card funds to the Galapagos Conservancy.

QST Cover Plaque Awards are given to the author or authors of the most popular article in each issue. *You* choose the winners by casting your vote online at

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HD8M DXpedition to the Galapagos Islands

This DXpedition managed to make a sizable donation toward the preservation of this precious ecosystem. Here's how they did it.

Jim Millner, WB2REM

The Galapagos Islands are located on the equator off the coast of Ecuador and consist of 17 larger islands, and hundreds of smaller islets and rocks. The HD8M team visited two of the islands — Santa Cruz and Isabela. The archipelago was formed by underwater volcanic activity three to five million years ago. In geological terms, these islands are considered relatively new.

In 1835, Charles Darwin was one of the first naturalists to observe the unique nature of the Galapagos wildlife. The animals are not afraid of humans because they evolved in isolation from them or other large predators, so had no reason to fear them. After a couple of the tortoise species were hunted to near extinction, 97% of the land and surrounding water was designated a national park to protect the Galapagos wildlife and flora.

The group of amateur radio operators that participated in the HD8M 2017 and 2019 DXpeditions traveled to the Galapagos for different reasons. Ellis, N1MWJ (SK), a retired park ranger, had a keen interest in wildlife. Mark, WY1G, a birdwatcher, was excited about observing new avian species. Bill, W2WCM, was on his first DXpedition. The rest of us, including Nancy, KG0YL, ARRL Section Manager for North Dakota, were amateur photographers and world travelers. Ham radio was the glue that bound us together, and the adventure is what excited us.

Isabela

The HD8M team traveled to Isabela Island in 2017. Isabela is the largest of the Galapagos Islands. It is easily reachable by small twin-engine prop planes, which fly daily from Baltra Island Airport. It is also possible to get to most major islands by ferry.

Isabela Island was chosen because of its beautiful volcanoes, abundance of wildlife, and limited develop-

The hexagonal beam antenna that was used for the HD8M operation on Isabela Island. [Jim Millner, WB2REM, photo]

Joel R. Hallas, W1ZR, w1zr@arrl.org

The Doctor is In

Adding a Linear Amplifier Requires More Interconnections

Q Tom, W1PDI, asks: I recently ordered my first linear amplifier. What's the appropriate sequence of interconnections, and what type of coax should I use? I'm sure it's transceiver-to-amplifier, amplifier-to-antenna tuner, antenna tuner-to-antenna. But where in this setup does the dummy load go? If I wanted to use a standing wave ratio (SWR)/wattmeter, where would that fall in the path described above?

A Your sequence is correct. The jumper from the transceiver output to linear amplifier input is likely to need to carry 100 W or less, so the coax can be RG-8X, or even RG-58. The jumper from the linear amplifier output to the tuner input will need to carry 500 – 1,500 W, depending on amplifier ratings and drive level, so it should be RG-213 or equivalent larger coax. The tuner needs to be rated at the power level of the linear output — probably not the one you used with your transceiver by itself.

Coax (or window line) from the tuner output to the antenna also needs to handle 500 – 1,500 W, so it should be RG-213, if coax is used. Most window or open-wire line should be suitable.

Note that any other items in the antenna system should also be appropriately rated, including for example, switches, filters, and lightning arrestors. Also, chances are that the linear will need a 240 V ac supply, at probably 20 A. Some 500 – 600 W output linears can be run from 120 V ac, but if so, it'll need to take about half of the available current on a 15 A ac line circuit.

If you just want to test your transceiver into a dummy load, a 100 W load can stay on any unused antenna output of the transceiver. On the other hand, you will likely also want to test the linear into a dummy load. If so, a high-power dummy load (at least rated to the amplifier output level) could be on an extra output of the linear. If there's an available output port on the tuner, the load could be situated there as well, and the tuner switched to bypass to that port. This can also be used to test just the transceiver by putting the amplifier in standby mode.

A power meter can go in line with any of the jumpers, depending on what power you want to measure. If you want to use the power meter to tune a manual tuner, it should be between the amplifier and the tuner (it's best to adjust the tuner at low power with the amplifier in standby and the transceiver at 25 W or so). If you put the tuner in standby, you can check the SWR of the antenna itself, again, best at low power. If the tuner doesn't have a standby position, you'll need to move the power meter to the connection between the tuner and antenna (see Figure 1).

Q Derick, AB9PR, asks: In a podcast episode on antenna switches, you cautioned against having two radios connected to

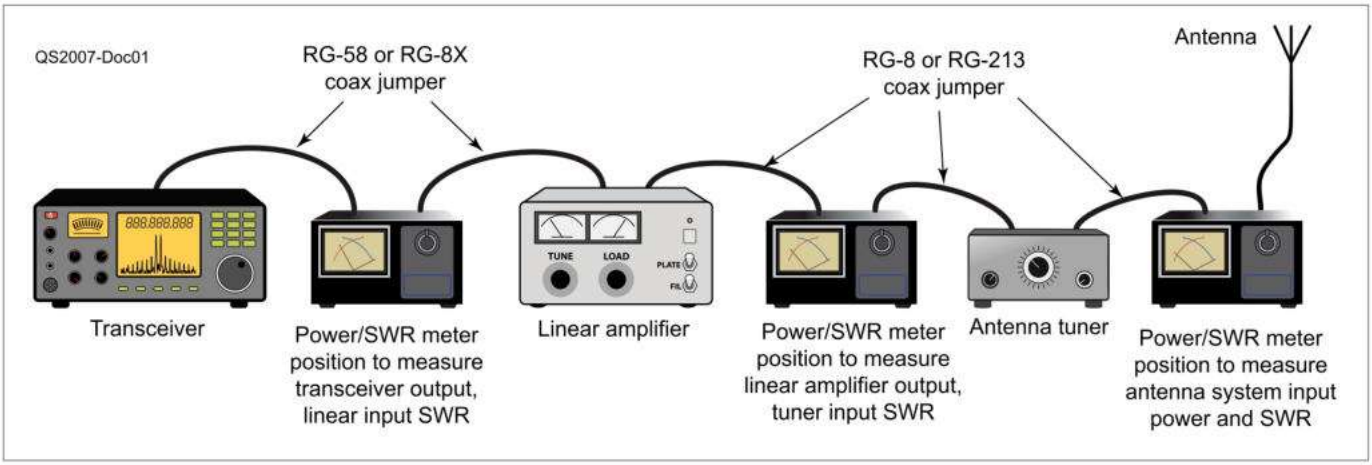

Figure 1 — A diagram showing the interconnections of a typical high-power HF amateur station, including the types of coax needed and the locations of a power/SWR meter to measure at different parts of the system. Usually only a single power meter is employed and, if between the amplifier and tuner, can also measure the transceiver output if the amplifier is placed in bypass mode.

ports on the same switch without ensuring that there's sufficient isolation between ports. This is because a transmitted signal from one radio could couple through the switch to the receiver of the other radio and possibly damage it. Is this equally the case whether the second radio is powered on or powered off?

A It's more of an issue if the second transceiver is turned on, because a strong signal could get amplified within a high dynamic-range transceiver and damage internal components. But even powered-off equipment can be at risk — typically components closer to the antenna connector are most likely impacted in a powered-down transceiver. For example, many transceivers have a resistive attenuator at the front end, often made with ¼ W (24 dBm) rated resistors. Those can be at risk, depending on attenuator setting, as well as the safe voltage threshold of input inductors and RF pre-amplifier transistors.

But this is typically only the case if the RF reaching the second transceiver is greater than 10 dBm, because we test transceivers in the ARRL Lab at that level as part of dynamic range testing, and have never had a failure. Some transceivers at W1AW have had front-end damage over the years.

I measured the signal strength from each of the antennas at W1AW during code practice with 1 kW output on all bands and found levels of up to about 20 dBm on non-transmitting antennas. There's no way to tell if the damaged transceivers were damaged from RF, or from nearby coupled lightning, but I consider that 20 dBm may be an unsafe level, based on the limited evidence. It's unfortunate that manufacturers don't tend to specify the maximum safe RF input level of their transceivers, but at least we know that any transceiver that has been tested in the Lab within the last few years (since we started doing IMD dynamic range testing) is likely safe at least to a +10 dBm input level.

If the transmitter is putting out 100 W (+50 dBm) and the isolation between switch ports is at least 40 dB, it should be marginally safe. But that's right at the threshold and the actual isolation will be less if there are loose connector backshells, poorly manufactured or soldered coax shields, or poor connections of the coax connectors to the switch body. I'd aim for at least 50 dB port-to-port isolation, and check and keep all shields tight.

Many, including me, have had switches between transceivers and haven't had problems, but it's hard to tell if it's good design or good luck.

Note that if you run a legal-limit linear, and have it before the switch, that increases the port level by up to 12 dB, requiring that much more isolation. Usually, it's possible to have the linear (unless you have multiple ones — perhaps one on each radio) on the antenna side of the switch, avoiding that problem.

Reputable switch manufacturers should provide isolation ratings. A number of popular switch lines include specifications on their web pages. If there are no ratings, I would steer clear if you want to use the switch in this application.

Q John, KF6EOJ, asks: I have a commercial electrical quarter-wave multiband trap vertical antenna that's ground-mounted via a steel pipe. For years, I've had somewhat of a narrow rectangular "radial" system made up of cut-to-length insulated wire, that's about half on dirt and half on concrete. To complicate matters, it's a spaghetti mess in a narrow garden and storage area that I've tripped over too many times.

I had an idea to use metal hardware cloth instead. The area is about 3 feet wide by 30 feet long, electrically tied to one of the antenna's ground lugs. Any idea if this would work? Right now the existing wires seem to result in a different SWR each day, depending on the weather or if the area is wet or dry. Just for reference, I tried my antenna with just the steel post and no radials. I was surprised to see that I got a 1:1 SWR on 20, 40, and 80 meters, on the FT8 frequencies. Should I stop while I seem to be ahead?

A This is one place where a 1.5:1 SWR is likely better than a 1:1 SWR. A 1:1 SWR means that your antenna system impedance is about 50 Ω, a perfect match to your coax. All power is going directly toward your antenna and ground system.

The problem is that the impedance of a ¼-wave vertical fed against perfect ground is about 35 Ω (1.43:1 SWR). That represents all of your power going to your antenna (none to your ground system), meaning the antenna feed (not necessarily the antenna, which the SWR meter doesn't know about) is 100% efficient.

By removing your ground radials, your 1:1 SWR indicates that you've inserted about 15 Ω of ground resistance (35 + 15 = 50). This means that the voltage going to the antenna system splits with 30% heating the ground beneath your antenna and 70% going to the antenna. While the transmitter may be happier, your transmitted signal will be down 3 dB or about ½ an S-unit.

Although sometimes that doesn't matter, in a pileup you want all you can get! Hopefully the trash collector hasn't carted off your radial wire yet.

Do you have a question? Ask the Doctor! Send your questions to "The Doctor," ARRL, 225 Main St., Newington, CT 06111, or email your question to: **doctor@arrl.org**.

Also listen to the archives of episodes of the *ARRL The Doctor is In* podcast, sponsored by DX Engineering, on iTunes, Blubrry, Stitcher, or on the ARRL website at **www.arrl.org/doctor**.

Paul Wade, W1GHZ, w1ghz@arrl.org

Microwavelengths

Focusing a Parabolic Disk

Most microwave activity, at least in the north, occurs during the summer. Many microwavers are getting the dishes ready and breaking out their portable stations. The most important part of a parabolic dish is making sure that the feed horn is at the focus of the dish.

I occasionally hear of someone adjusting the feed position in their backyard using a signal source, moving the feed in and out from the reflector to find a peak. I usually advise against this, however, my calculations have found that the errors are quite a bit smaller than I expected, so backyard adjustments may be good enough.

Focusing the Energy

The RF energy received by a dish from a distant source travels in a parallel beam and is reflected to the focal point of the parabola. We draw imaginary rays (like the black dashes in Figure 1) to show the path. But when we focus on a closer source (in the backyard), the energy is focused at a point further away from the reflector (shown by the blue dots in Figure 1). This is due to the geometry of the parabola — a ray arriving at an angle to the surface of the reflector is reflected at an equal and opposite angle. Because the surface is curved, all rays in the beam arrive at an angle. When the rays arrive at a differ-

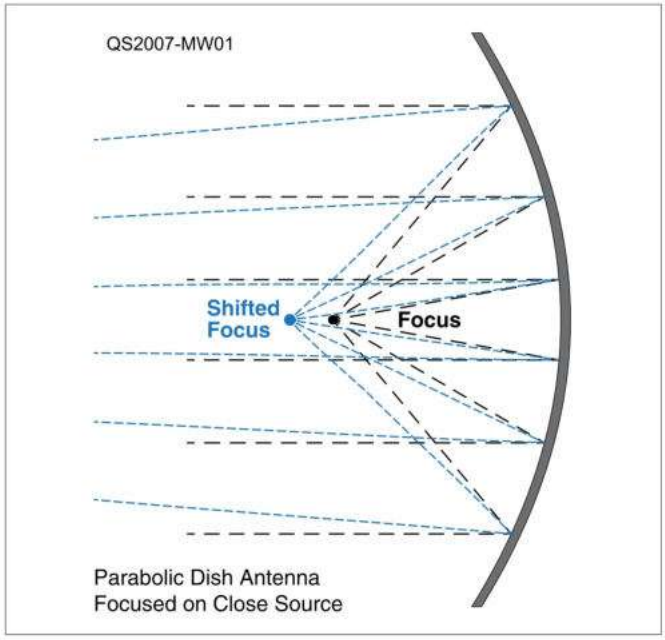

Figure 1 — A parabolic dish antenna focused on close source results in shifted focal point.

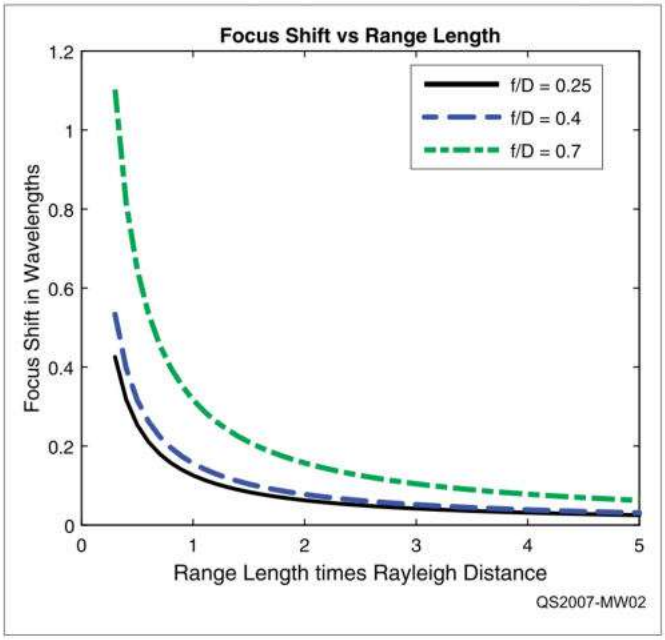

Figure 2 — Focus shift versus range length, showing large focus shift at short range.

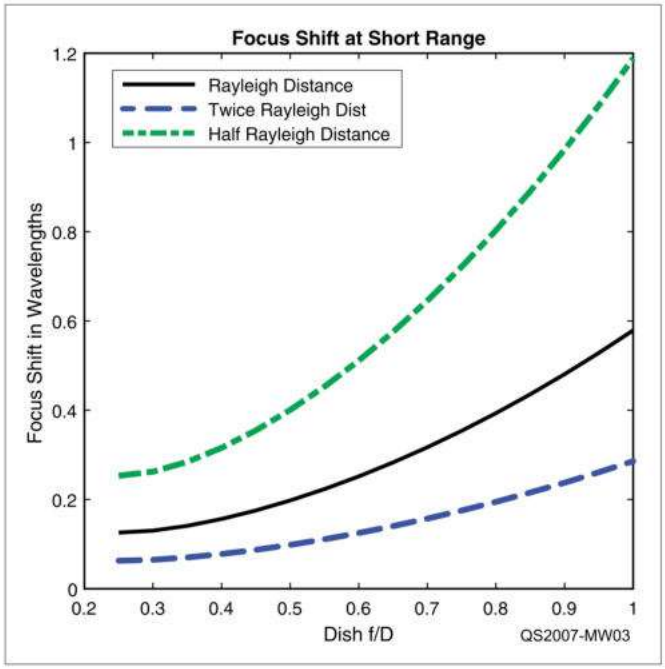

Figure 3 — Focus shift is more severe for dishes with large F/D ratios.

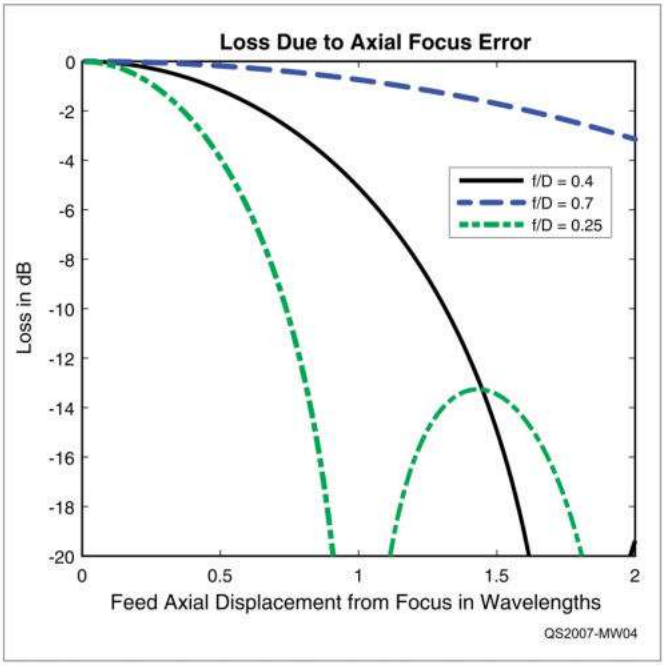

Figure 4 — The loss resulting from axial focus error.

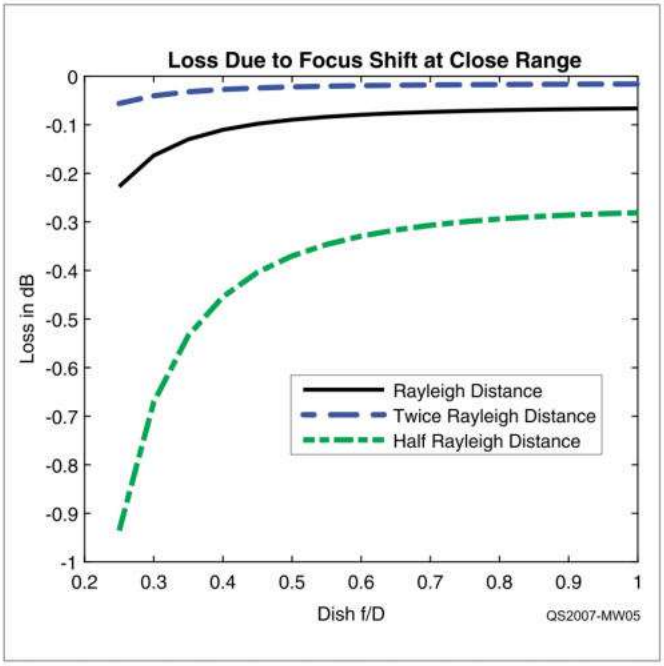

Figure 5 — The loss due to focus shift on short antenna range.

ent angle from the closer source, they're reflected at the equal and opposite angle, missing the focal point.

Calculating the Rayleigh Distance

We take advantage of the common geometry of parabolic reflectors — all dishes with the same focus to diameter ratio (F/D) have the same geometry. Another factor is the Rayleigh distance of an antenna, which is considered to be the boundary between near-field and far-field radiation. Rayleigh distance equals $2D^2/\lambda$, where D is the diameter of the parabola — all dishes of the same size have the same Rayleigh distance.

A good antenna range should be making measurements in the far field, so the range length is greater than the Rayleigh distance. For example, a 2-foot dish at 10 GHz is 21λ in diameter, so the Rayleigh distance is $2 \times 21^2 = 882\lambda$. Multiplying by the wavelength of 28.94 millimeters gives a distance of 25.5 meters (or about 84 feet), which might be reasonable in a backyard. But the Rayleigh distance grows as the square of the size, so the distance for a 4-foot dish is 336 feet — a football field.

Knowing all this — parabolic dish geometry and range, and Rayleigh distance — allows calculation of how far the focus is shifted. Working in wavelengths, so that frequency doesn't matter, we find that the focus shift in wavelengths is a function of the dish F/D and the ratio of the distance to the source to the Rayleigh distance. The focus shift is plotted in Figure 2, showing that the focus shifts rapidly as the source is moved closer than the Rayleigh distance. We can also see that dishes with large F/D suffer more focus shift than deep dishes with small F/D. Figure 3 shows this more clearly.

But what really matters is the effect of focus shift; how much loss is a result? The loss due to an axially misaligned feed is shown in Figure 4 (the loss is the same whether the feed is too far from or too close to the dish). The loss due to focus shift on a short range is the same as having a misaligned feed. What's also clear is that deep dishes, with F/D of less than 0.4, are much more sensitive to feed misalignment.

The loss in Figure 4 is severe for large focus errors, so getting it right is important. But the shift in Figures 2 and 3 is smaller, except for very short-range distances. Calculating the loss due to the focus shift in Figure 5 shows that the loss is quite small, as long as the source distance is larger than the Rayleigh distance. Deep dishes are affected more by short distances.

Conclusion

We can conclude that backyard adjustments are not as bad as I had previously thought. Adjusting a feed on a short antenna range only results in a small error, less than a quarter wavelength, if the range is longer than the Rayleigh distance. The result will be an antenna whose gain is only a few tenths of a dB less than if adjusted perfectly. But there are many other factors that reduce gain.

Hints & Hacks

Sticky Terminal Strips; Needling a Headphone Cable, and Repairing Tube Sockets

Mounting Terminal Strips with a Unique Adhesive System

I have a 12 V dc power supply that powers my transceiver as well as several smaller accessories. This supply has two high-current binding posts dedicated to the transceiver and a pair of spring-loaded terminals for use with stripped wire meant to power accessories. Unfortunately, the spring-loaded terminals will hold only two pairs of wires, and because I have additional accessories that required dc power, I needed to provide additional 12 V dc connections.

My preference for an application like this is to use terminal strips and small crimped lugs. My plan was to run a pair of medium-gauge wires from the spring-loaded terminals on the power supply to a multi-position terminal strip that would provide additional dc feed points. It was important that the terminal strip be easily accessible without the need to drill mounting holes in equipment or resort to something unsightly or awkward. I also wanted to be able to easily remove or relocate the terminal strip as my needs changed.

My solution was to use one of the unique two-part adhesive strips supplied with the popular 3M "Damage-Free Poster Mounting Systems" sold in hardware stores. These fasteners are designed to be easily removed without damaging finished surfaces like painted or wallpapered walls. Key to the clever design is an integrated pull tab that, when stretched, will safely and cleanly release the adhesive's impressive grip. While normally sold packaged with mounting hooks, these adhesive strips can also be purchased separately.

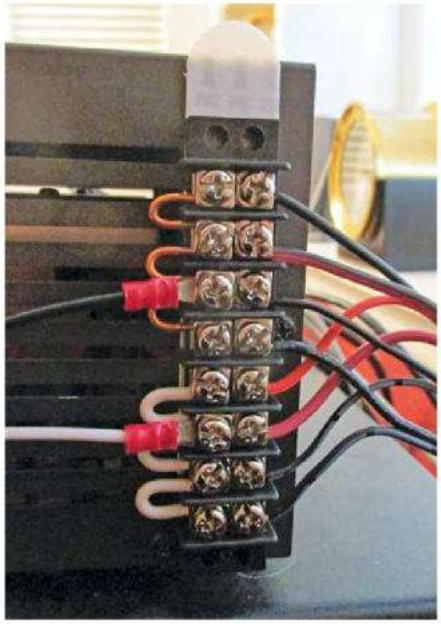

Figure 1 — An eight-section barrier-type terminal strip mounted vertically to the side of the power supply using an adhesive strip.

As seen in Figure 1, I took an eight-section barrier-type terminal strip and jumpered four terminals of the strip together for the positive feed and the other four terminals together for the negative. I then mounted the terminal strip vertically to the side of the power supply using one of the adhesive strips and ran a pair of wires back to the spring-loaded terminals. This gave me a neat, accessible, and flexible way to connect up to four additional accessories.

Note that these strips come with one side labeled "wall side." To use, strip the release paper off the unmarked side and press it firmly against the back of the terminal strip, making sure that at least ½ inch of the release tab sticks out beyond the end of the terminal strip. Next, pull the release paper off the wall side of the adhesive strip and press it and the terminal strip securely against the mounting surface. Take care to position the terminal strip exactly where you want it, because once pressed into place, the only way to reposition it is by slowly pulling the release tab to free the terminal strip and starting over. Also, be sure to use good practices to ensure that appropriate wire sizes are used and that the overall current capacity of the power supply isn't exceeded.

Obviously, this system can be used to mount many other types of items such as small SDR modules, rotary antenna switches, and so on. Two adhesive strips can be used for larger accessories, even though the holding power of just one strip is pretty impressive. — *73, Barry Green, W1JFK,* **w1jfk@arrl.net**

Rejuvenating Tube Sockets

Dino Papas's, KLØS, "Amplifier Tube Socket Repair" item in the February 2020 "Hints & Hacks" column reminded me of a fix we had for seven- and nine-pin tube sockets when I worked in a shop that repaired TV tuners in the 1970s.

The procedure involves inserting a dental pick between both sides of the

metal clip and the plastic socket housing, gently massaging the metal back into shape to retighten it, being careful not to crack the plastic. From there, squirt contact cleaner (non-lubricating) into the holes and run the tube in and out of the socket a few times to clean off any oxides or carbon that may have built up, and to ensure proper fit. The excess cleaner can be allowed to dry or be blown off with dust remover spray. Be careful not to over-tighten the clips, or damage to the tube can result when reinserting it. This method also works very well on the sockets of older, larger tubes. — *73, Joe Falletta, W6UDO,* **w6udo@arrl.net**

Repairing Headphones

Recently, I found that one side of my headphones had gone silent. I was able to take apart the two headphone speakers and, by testing continuity between the speakers, determined that the issue was a discontinuity in the shield of the very thin cable that runs up through the headband from one side to the other. I first assumed that this would be the end of the headphones, because finding a replacement for the tiny cable would be difficult and would require disassembly of the entire headband.

Then I had the idea of trying to use a needle to probe the coax. I got a 1½-inch needle from our sewing supplies and securely grasped it with the mini-test clip (see Figure 2) of my multimeter. I set my multimeter to resistance measurement with the buzzer enabled for continuity. With one end of the meter clipped to the shield termination on one speaker, I walked my way down the cable, gently pushing the pin and test clip combination into the wire. It didn't take much pressure to get a beep. Sure enough, after I continued along, the beep stopped and I had found the spot where the cable was broken. It was at a swivel joint of the headset earpiece. I removed a section of insulation, soldered a small wire to reunite the separated cable, and then covered everything with a small amount of heat-shrink tubing. It took a while to get everything back together again, but my headphones sound as good as ever.

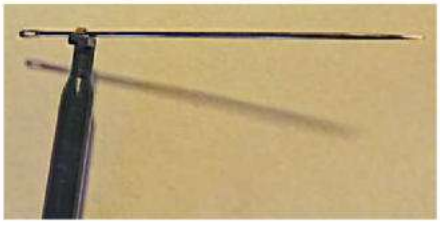

Figure 2 — A sewing needle can be put to work as a continuity probe in tight spaces.

I think this would have worked if it was the inner wire rather than the coax shield that was broken, but it would take more pressure and finesse with the needle. — *73, Dick Grote, K6PBF,* **k6pbf@arrl.net**

A Reinforced Speaker-Wire Dipole

When purchasing wire for my dipole antennas, I opted for speaker wire because it is inexpensive, comes in pairs, and can be split for providing a lot more wire for antenna projects. Stranded electrical wiring is probably stronger and comparable in price.

However, I needed to solve the strength problem of stringing the speaker wire up in the air without breakage. My idea came from a worker at the telephone company, who commented about supporting copper wires with steel cable. Mason's cord seemed to be readily available, and would serve a similar purpose, but I worried that it might not hold up well when wet and sun-bleached over time.

During another visit to the store to purchase replacement string for my weed trimmer, it occurred to me that I may have chanced upon a viable alternative for supporting my speaker-wire antennas. I decided to try it with my next project: a speaker-wire inverted-V dipole.

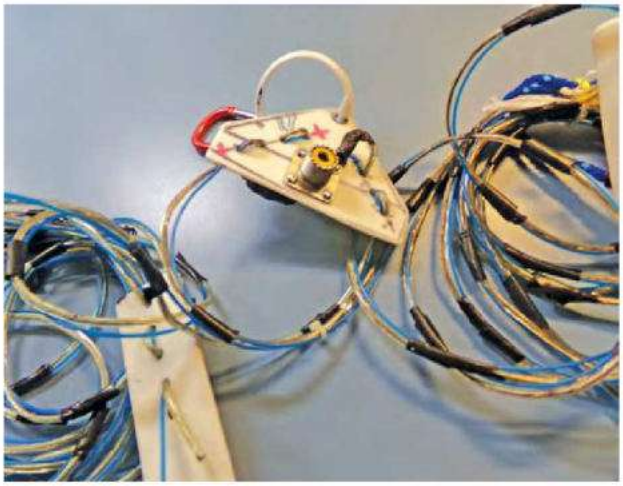

Figure 3 — The finished antenna, made from inexpensive plastic cutting boards and speaker wire. The speaker wire is supported by blue weed-trimmer string.

That same day, I purchased several plastic cutting boards at a local discount store for making the end insulators and center connector. I cut the speaker wire into two lengths that I had calculated for a half-wavelength at 14.250 MHz.

I used electrical tape to secure the speaker wire to the string line. I drilled holes in both the center connector and insulators for weaving the wire and trim line through the holes to relieve the strain and prevent stretching (see Figure 3). The result is a lightweight HF antenna that's also great on a budget. — *73, Manuell Alvarez, KB8ITC,* **alvarm@citlink.net**

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Steve Ford, WB8IMY, wb8imy@arrl.org

Eclectic Technology

Fuji-OSCAR 99 Soon in Full-Time Amateur Operation

*For this month's column I have a guest contributor, Scott Richardson, N1AIA (**scottxot@gmail.com**). He brings some interesting news about the Fuji-OSCAR 99 satellite.*

NEXUS (Next Generation X Unique Satellite), a project of Nihon University's College of Science and Technology and the Japan Amateur Satellite Association (JAMSAT), is anticipated to complete all seven of its planned missions in August, after which the CubeSat will become available for full-time amateur radio operations.

The linear transponder had first been tested on January 26, 2019. Over the subsequent year, it was periodically switched on for approximate 20-minute activations covering all continents. Numerous hams reported making contacts via FO-99 during these brief tests.

The mode V/U SSB/CW transponder has an uplink between 145.930 and 145.900 MHz and downlink between 435.880 and 435.910 MHz. The satellite transmits from an altitude of 500 kilometers with downlink power of about 500 mW.

NEXUS launched January 18, 2019, from the Uchinoura Space Center at the Japan Aerospace Exploration Agency. The control team confirmed downlink and uplink capability on the first orbit and successfully tested two data modes, SSTV, and a digitalker, plus the linear transponder, in the satellite's inaugural year.

Using the call sign JS1YAV, the satellite transmits a continuous CW beacon from low-Earth orbit. During the first year, 61 stations from 14 countries submitted more than 500 CW reception reports containing measurements of battery voltage and angular velocity. These reports supplemented data downlinked via high-speed digital modes at the Nihon University ground station.

The satellite was assigned seven missions, four of which were completed within the first year. FO-99 successfully tested a $\pi/4$ QPSK transmitter (38400 bps), an FSK transmitter (up to 19200 bps), and the transponder, while also demonstrating a specially developed camera (N-CAM). Some ground stations received high-definition images (2592 × 1944 pixels) from the satellite and the NEXUS team captured moving images in SVGA with a maximum frame rate of 16.88 fps.

The remaining missions — fully verifying the practicality of the QPSK and FSK transmitters and completing a map of signal strengths received in the 145 MHz band worldwide — are expected to be completed in August.

The Fuji-OSCAR 99 CubeSat prior to launch. [Photo courtesy of the NEXUS Project Team]

The NEXUS team released a detailed annual report in January, coinciding with the first anniversary of the satellite's launch. Details of daily operational status are in the report, which is available at **http://sat.aero.cst.nihon-u.ac.jp/nexus/E4_news.html**.

Current satellite transponder operational status can be monitored at **amsat.org/status**.

This is a high-definition image of clouds over the North Pacific Ocean near Japan captured by N-CAM, a camera specially developed for NEXUS, at about 8:40 AM local time on February 4, 2019. [Photo courtesy of the NEXUS Project Team]

The Lunar Legacy Special Events

A series of on-air special event stations that celebrated the 50-year anniversary of the moon landing.

Bob Wertz, NF7E

In 2019, NASA celebrated the 50th anniversary of the first moon landing. To mark this milestone, a year-long Lunar Legacy (LL) celebration was kicked off at Lowell Observatory in Flagstaff, Arizona.

Partnering with the Lunar Legacy Committee

The Northern Arizona DX Association (NADXA) jumped at the chance to take advantage of the Lunar Legacy celebration by using it as the backdrop for a special event station. NADXA President Jack Lunsford, NT7MM, and I attended an LL committee meeting in February 2019, to begin the process of integrating amateur radio and the LL campaign to create an educational special event.

There were many businesses represented at the meeting, as well as members of the media, Northern Arizona University, the Flagstaff Public Library, the US Geological Survey (USGS), Meteor Crater Natural Landmark, Flagstaff Public School system, and more. We spoke to the group and developed a plan to operate Lunar Legacy special event stations at all four sites where the Apollo astronauts trained in northern Arizona, including Sunset Crater Volcano National Monument, Meteor Crater Natural Landmark, Lowell Observatory, and the Grand Canyon.

Ron Gerlak, KG7OH, obtained the call signs for each special event. We planned to operate from each site for 2 days at the weekend kickoff and then each of our members would operate from their home station, for the remainder of each 9-day event.

Sunset Crater and Cinder Lake

In March 2019, we had our first LL-scheduled event, operating from Sunset Crater Volcano National Monument (K7S) and the adjacent Cinder Lake. This is an

NADXA members stand in front of the Grover, a 1971 training rover built for Apollo 15 and 17 astronauts to use at the Cinder Lakes training ground. Left to right are Bob Wertz, NF7E; Jack Lunsford, NT7MM; Larry Gilbert, WB7EUJ; Nick Elias, N3AIU; Ron Gerlak, KG7OH, and Ken Feld, KF7DUR. [Ken Feld, KF7DUR, photo]

USGS members with astronauts Jim Irwin and David Scott in the rover at Cinder Lake. [Photo courtesy of Astrogeology Science Center]

important site for the moon landing because after astronauts studied the moon's craters, they chose the Cinder Lake area to make exact replicas of the craters where they would be landing. They teamed up with USGS members and used dynamite to create the replicas, where the astronauts tested rovers and a prototype moon buggy).

During this event, we made 2,156 contacts using SSB, CW, and FT8. We had few visitors, but then we got on the air, and heard many hams' stories. John Ellis, W5PDW, who was 29 years old at the time, said he remembered watching the moon landing with his parents and his fiancée on their color TV.

Meteor Crater Natural Landmark

Our second LL event was at Meteor Crater Natural Landmark (K7M) in April 2019. Meteor Crater marked the spot where astronauts had trained by walking into the crater in their space suits. In doing so, they tore holes in the suits, which needed to be redesigned. Luckily for them, the rip didn't occur on the moon.

Thanks to Lanah Butterfield, Vice President of Meteor Crater operations, we were able to operate from inside their courtyard, bringing many vistors to our station. We made 3,756 contacts.

Lowell Observatory

On July 20, 2019, the actual 50th anniversary of the moon landing, we started our third LL event at Lowell Observatory (K7O). We set up using two trailers, just outside the Pluto Discovery telescope dome. We were able to make 1,945 contacts, and we had so many visitors that, at one point, they surrounded our operating trailer. While getting a lot of attention for operating FT8, Larry Gilbert, WB7EUJ, a retired teacher, was able to answer questions and explain amateur radio and what he was doing.

The Grand Canyon

Our last LL event, starting in late August, was held at the Grand Canyon (K7C). The Apollo astronauts went there to study the geology formations. Mickey Meredith, WW4MM, obtained a permit to operate inside the national park. Because the park doesn't allow any stakes in the ground, we used a tripod for some antennas and a truck bed with a 20-foot aluminum tower. We made 1,836 contacts during this week-long event.

Acknowledgments

We made over 9,700 contacts, celebrated the anniversary of the moon landing, and spread the word about ham radio. It was such a success, the LL committee asked us to participate in future celebrations. We couldn't have done it without our guest operators, including Chris Gilbert, KA7TAZ; Ted Hartson, WA8ULG; Kirk Smith, N7AZZ; Rex Mauldin, N7NGM, and Mary DeGeoso, KF7NJK. We are also grateful to David Schaubert, NJØW, who made a certificate with four QSL cards, one for each site to help recoup our LL costs. You can see these on our club website.

You can find out more about upcoming events at **www.nadxa.com**. With the astronauts training again for the 2024 moon landing, this may not be the end of our story.

First licensed in 1976, Bob Wertz, NF7E, is a charter member of the Northern Arizona DX Association. He is a DX chaser and a contester. He also created the Distance Challenge, which is held at Quartzfest, and he is an originator of the annual multi-station Route 66 On the Air special event.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Online Club Meetings Ease Shelter-In-Place Isolation

Use videoconferencing software to keep your club vibrant in this time of social distancing.

Lee Chambers, KI7SS, and Phil Cornell, W7PLC

Under a "stay home" order due to the COVID-19 pandemic, Washington state's Olympia Amateur Radio Society (OARS) members were feeling the impacts of isolation, missing the camaraderie of meetings, programs, and much more. Forced to implement a solution, we evaluated the cost and benefits of internet video conferencing programs available, settling on Zoom video conferencing software. It fit our budget and participant needs, and it works on any platform — PC, Android, iPhone, or iPad.

Zoom Features

Think of Zoom as a video net, complete with a Net Control Station in the form of the host, check-ins as your image on everyone's screen, and message traffic as the chat function and screen sharing. Zoom has remarkably easy integration with any program on the presenter/host's laptop, which allows for PowerPoint presentations that can be viewed by all participants. During the live video, participants can comment, ask questions, or transfer files using the chat function. There are even breakout Zoom Rooms where subgroups can meet and report back.

Setting It Up

Members have the option to join a meeting with audio only, video only, or a full audio/video connection. A device with a camera, a microphone, and an internet connection are the bare minimum requirements. All modern laptop computers and smartphones have these features built in, making Zoom a logical answer to the feeling of social isolation created by the pandemic.

With the purchase of a Zoom license, which can be purchased on a monthly or yearly basis, we were given the ability to host meetings with up to 100 participants. Higher priced plans are available for larger groups. To participate in any online meeting, the host must distribute their Zoom-assigned 9- or 10-digit ID number.

Typical OARS Zoom meeting on March 25, 2020. [Phil Cornell, W7PLC, photo]

Signing up for an account is also easy. Go to **Zoom.us** and create an account by clicking the **SIGN UP, IT'S FREE** button in the upper right corner of the screen. After viewing the Privacy Policy and Terms of Service, you enter an email address, or sign up with a Google or Facebook account. Zoom will send an email with the directions to create your account.

When you start Zoom and join a meeting, the video and audio controls are in the lower left corner of the screen. The host will know you've joined, but won't see you until you enable the video, and once you're in the meeting, you can control your audio. You can choose to view participants side-by-side while the presenter is talking, or the presenter may fill the whole screen.

Because of expanding use of video meetings, we have heard of internet slowdowns, but meeting during the evening, on weekends, and during off-peak hours, we haven't seen any systemwide problems.

Balancing Conversations

Our club's in-person meetings are typically hosted by our club president, and we break off into smaller groups for a portion of the meeting. While in-person meetings can have breaks for individual or subgroup conversations, an online format makes that a challenge. Zoom Rooms offer some possibilities, but don't work as well for people to switch between groups easily.

The club president — acting as a host and Net Control of sorts — must, therefore, be prepared to balance these subgroup conversations. A list of potential topics is useful to help the host stay organized and on point. Meetings may become longer, so participants need to be patient with each other, but in our experience, we have benefitted from opinions that otherwise may not have been shared in an in-person format where groups break away from each other.

We have also discovered that this group dynamic is more convenient for members — enough to ask for more meetings. Having previously met once a month, we now meet weekly. Without driving obstacles, more members are able to participate. We even had one member participate from across the country.

Continuing to Overcome

Hams innovate — it's in our blood. As an alternative to face-to-face and physical group meetings, Zoom is a very easy, inexpensive choice for almost any group. Social distancing is necessary to combat the spread of the COVID-19 virus, but we will find ways to connect.

Online CW Class for Children and Teens

Robb Zarges, K2MZ

Our world changed drastically in March with strict COVID-19 restrictions. For children, that change took the form of school from home. With 30 years of working with teens and children, I was inspired to offer Morse code classes for children and teens through the Long Island CW Club.

Within 2 weeks of spreading the word through emails to club members and Facebook, Twitter, and **QRZ.com** posts, we had 57 kids from 31 states and four countries. These results far exceeded my expectations.

I split the material into three Zoom classes — kindergarten to third grade, fourth and fifth grades, and sixth to 12th grades. We meet every day. Three weeks into our classes, we scheduled a fourth class to account for 15 additional students.

Within a month and a half, all the children had learned all 40 characters of CW, learned how to send and receive a CQ, and can use their made up call signs to send the first stage of the CW contact protocol. We have 5-year-olds that are just learning to read that can copy and send short messages to classmates. We have teenage girls meeting in Zoom Rooms to practice on their own. We've had kids make keys out of LEGO, while others build oscillator kits. One student graduate from the beginner class posts a CW Joke of the Day on our class Facebook page. Additionally, because the class requires a parent to be within earshot, we've had parents start learning CW along with their children.

We've had generous donations of build kits, and 20 straight keys. With 75 children (60% girls) enrolled to date, we are planning to offer classes year-round, with the next set scheduled for mid-May. Enrollment has already begun with 30 children in the intermediate class and 12 children in the beginner classes. We plan to offer a summer Technician-class license exam prep class, too.

First licensed in 1959, Lee Chambers, KI7SS, is a former Navy A6A radar technician. He retired from an electronics career, is the past president of the Olympia Amateur Radio Society, and is an ARES member. He is the communications coordinator for several local events, has taught many license classes, and has moderated the Olympia OARS Info Exchange Net for many years.

First licensed in 1978, Phil Cornell, W7PLC, has been a member of OARS since 1982. He is in AEC-Training for Thurston County ARES. He enjoys DXing, contesting, participating in nets, and antenna building.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Simulated Emergency Test 2019 Results

Amateur radio operators showcase ingenuity and skill under the pressure of emergency scenarios.

James Plumlee, KI5DAZ, serves as Net Control Operator for the Hospital Net during the SET. The Tulsa Area Emergency Management Agency requested ARES maintain communications between the Tulsa EOC, the Broken Arrow EOC, and the Medical Emergency Response Center. A Winlink station was also used to send and receive messages during the test. [Paul Teel, WB5ANX, photo]

Steve Ewald, WV1X

The 2019 ARRL Simulated Emergency Test results document the outstanding efforts by many, including those involved in the ARRL Field Organization, Amateur Radio Emergency Service (ARES®), Radio Amateur Civil Emergency Service (RACES), SKYWARN, National Traffic System, and numerous other allied groups and individuals. Your collaboration and relationships with partner agencies, organizations, and groups help to make this annual national exercise a success.

SET Shows Anderson, Ohio, is Prepared

Justin Patrick Moore, KE8COY

Hamilton County (Ohio) ARES members participated in a Simulated Emergency Test of communications across Anderson Township on Saturday, October 5.

The Anderson Emergency Operations Center (EOC) was ground zero for county radio amateurs during this exercise, and Marty Newhall, KE8CEI, worked with the Anderson Fire Department to establish an amateur radio station at the EOC as an auxiliary and backup communications system. Groundwork for this station was established by former Fire Department Chief Mark Ober, with continued support from current Chief Richard Martin and Assistant Chief Bob Herlinger. The station was capable of city, region, state, and nationwide communication. All radios and antennas were tested.

Using portable and mobile radio equipment, other ARES members fanned out to several different locations throughout Anderson and surrounding areas to exchange messages from their field locations to the EOC and pinpoint locations where radio signals might have trouble getting through.

Scenario Challenges Moore and Lee County, North Carolina

Lionel Bryson, N4YYL, EC of Moore County

On October 26, 2019, the Moore County ARES conducted its SET, a drill coordinated under the aegis of Moore County Emergency Management and the North Carolina Emergency Operation's Auxiliary Communications program. This exercise also involved neighboring Lee County's emergency response programs.

The scenario called for a "widespread catastrophe" that struck the region. All surrounding counties, except Moore and Lee, had been impacted with widespread power, telephone, cellular, and internet outages that impacted citizens and county governments alike. State emergency managers asked that Moore and Lee counties plan to receive medically stricken victims and prepare to provide transportation, communication, and medical support to surrounding counties.

Volunteer amateur radio operators from Moore and Lee counties and the Lee County Community Emergency Response Team (CERT) deployed from their homes with their own equipment to Moore Health

SET Scores

For an explanation of SET scores, visit **www.arrl.org/public-service-field-services-forms** and click on "SET Score Card."

2019 SET Top Ten

Section	Points
ARES Activity	
Alabama	13,876
Ohio	3,528
Eastern Pennsylvania	2,092
Eastern New York	1,799
Wisconsin	1,746
Santa Clara Valley	1,502
Southern New Jersey	1,434
Western Washington	1,228
Western Pennsylvania	1,201
Georgia	962
Section/Local Nets	
Mississippi	5,247
Wisconsin	5,107
Alabama	3,659
Ohio	924
South Texas	536
Western New York	412
Georgia	343
Connecticut	312
Michigan	251
Western Pennsylvania	249

During the St. Charles County ARES SET, a team learned to assemble and test an NVIS antenna for a station within a communications trailer. Another team deployed a dual-band and a TV antenna for the station in the field under simulated emergency conditions. [William Grimsbo, NØPNP, photo]

Department, FirstHealth Moore Regional Hospital, Moore County Airport, and counterpart locations in Lee County. Conducting nonstop radio checks from a wide variety of locations, these operators transmitted simulated medical supplies and air-evacuation emergency messages across county lines via radio to the state emergency operations leadership and handled intercounty emergency medical transit drills via multiple four-wheel-drive vehicles.

All Hands on Deck in Wayne County, Pennsylvania, SET

Hank Grilk, WA2CCN, EC Wayne County

Of the 15 ARES participants in the Wayne County SET, three were deployed to the Wayne County EOC, two were deployed to a relay station at the mountaintop location of Manchester Township Municipal Complex, and seven operated from the simulated incident site. The other three ARES participants served as National Traffic System (NTS) liaisons at a station assigned to handle Winlink communications and at a station monitoring three local repeaters for possible emergency calls.

At the incident site, one station was set up at the Incident Commander's HQ (acting as the Communications Unit Leader), and other stations were dispatched to support served agency staff at a bridge over the Delaware River, at Detours North, West, and South, at the accident site, and with the state police officer in charge.

Once all stations were assigned locations, testing was conducted to determine optimum frequencies for local (on-site) communications and for relaying communications between the incident site and the EOC. We used 2-meter simplex for all communications, achieving our goal of successful communication from a simulated accident scene deep in a valley (along the Delaware River) back to the EOC over very mountainous terrain, where no other communications were possible.

During the event, the Wayne County EMA Deputy Director observed our test from the Radio Room in the EOC. Also, the EMA staff of Manchester, Pennsylvania, visited our relay station and our on-site stations. Most importantly, one of the three county commissioners visited the SET site and each of the ARES station locations. It was great exposure for Wayne County ARES.

ARES Activity

Area	Reporter	Points	Section
Atlantic Division			
Delaware			742
Section-wide	KB3KYH	742	
Eastern Pennsylvania			2,092
Montgomery Co.	W3EX	1,188	
Wayne Co	WA2CCN	190	
Lycoming Co.	KB3IPZ	155	
Cumberland Co.	W3AND	144	
York Co.	KB3LZJ	139	
Schuylkill Co.	N3RZI	106	
Chester Co.	KB3YCK	90	
Lehigh Co.	KC3BLF	80	
Southern New Jersey			1,434
Section-wide	WB2ALJ	738	
Burlington Co.	KC2GNQ	346	
Ocean Co.	WX2NJ	192	
Cumberland Co.	N2MHO	158	
Western New York			365
Otsego Co.	KD2HXE	216	
Chenango Co.	K2DAR	149	
Western Pennsylvania			1,201
Bedford Co.	KA3UDR	220	
Armstrong Co.	K3FAZ	218	
Allegheny Co.	NU3Q	186	
Crawford Co.	WW3S	136	
Washington Co.	KC3TOM	133	
Centre Co.	K3CWP	131	
Mercer Co.	NR3C	92	
Beaver Co.	N3TN	85	
Central Division			
Illinois			338
Lake Co.	K9DRW	182	
Williamson Co.	WA9APQ	156	
Indiana			134
Hendricks Co.	KB9DJA	107	
Kosciusko Co.	AB9ZA	27	
Wisconsin			1,746
Dunn Co.	KB9MMT	639	
NW District	KC9NVV	350	
Milwaukee Co., Waukesha Co.	KC9GMW	222	
Eau Claire Co.	K9NY	166	
Racine, Kenosha	KA9KJE	141	
Waupaca Co.	AC9F	87	
SE District	AC9CD	61	
Manitowoc Co.	KD9AQM	56	
Price Co.	AG9G	24	

Area	Reporter	Points	Section
Dakota Division			
Minnesota			364
Washington Co.	KAØHYR	230	
Carlton Co.	KCØAFE	134	
Delta Division			
Arkansas			355
Eastern Arkansas	W5WPN	303	
Poinsett Co.	NI5A	52	
Mississippi			867
District 8	AA5SG	272	
Lamar Co.	AG5GN	197	
District 7	N5ZNT	156	
Harrison Co.	W4WLF	147	
Scott Co.	KC5IIW	95	
Tennessee			77
Hamblen Co.	N4GFH	77	
Great Lakes Division			
Michigan			838
Monroe Co.	KE8BYC	641	
Saginaw Co.	KC8YVF	197	
Ohio			3,528
Montgomery Co.	KA5RUC	742	
Greene Co.	W8HJR	504	
Licking Co.	KD8SCL	446	
Coshocton Co.	AA8BN	408	
Huron Co.	KD8KWU	344	
Mahoning Co.	KD8NZF	304	
Shelby Co.	N8KZL	194	
Section 7	KD8SSJ	132	
Clinton Co.	WF8B	127	
Hamilton Co.	KC8EGV	106	
Miami Co.	KC9NVP	88	
Guernsey Co.	WD8SDH	77	
Jefferson Co.	N8CUX	56	
Hudson Division			
Eastern New York			1,799
Rensselaer Co.	WO2H	616	
Washington Co.	N1NDN	468	
Schenectady Co.	N2UZQ	224	
Columbia Co.	WA2KLP	222	
Albany Co.	KB2HWL	192	
Saratoga Co.	W2EMS	114	
Rockland Co.	N2GOP	26	
New York City-Long Island			269
Nassau Co.	KD2GXL	190	
Town of Southold	N2QHV	79	

Area	Reporter	Points	Section
Northern New Jersey			66
Manalapan Township, Monmouth Co.	N2UUS	66	
Midwest Division			
Iowa			155
Dallas Co.	KØWOI	77	
ARES District 2	AE5EI	34	
Tama Co.	KDØQ	22	
Cedar Co.	KØWLC	22	
Missouri			520
Boone Co.	NØAXZ	242	
Jackson Co.	KØUAA	189	
St. Charles Co.	NØPNP	89	
New England Division			
Connecticut			829
Region 2	WA1SFH	183	
District 5 South	W1QH	159	
South Windsor	K1XFC	91	
Danbury	WA2IZQ	77	
Woodbury	AG1YK	62	
Region 5	K2GAV	61	
Winchester	KA1WPM	57	
Region 1	N1DID	49	
Hartford Co., Tolland Co.	K1PAI	48	
New Hartford	NP2GG	42	
Maine			232
Cumberland Co.	WS1EC	232	
Northwestern Division			
Western Washington			1,228
Clark Co.	WB7OSC	394	
Pacific Co.	N7CVW	319	
Grays Harbor Co.	N7UJK	265	
Mason Co.	KA4VVA	160	
Lewis Co.	AC7SR	90	
Pacific Division			
Santa Clara Valley			1,502
Santa Clara Co.	N6MEF	1,088	
Cupertino	KN6PE	161	
San Benito Co.	W6TST	135	
San Mateo Co.	N6QAD	118	

Area	Reporter	Points	Section
Roanoke Division			
North Carolina			255
Moore Co., Lee Co.	N4YYL	255	
South Carolina			108
Abbeville Co.	KL7FO	108	
Virginia			329
City of Poquoson; York Co.	WB4UHC	118	
City of Hampton	KC4F	117	
Lancaster Co.	N1WR	94	
Southeastern Division			
Alabama			13,876
Calhoun Co.	AE4BL	3,835	
Jefferson Co.	WX4RON	2,599	
Bibb Co.	K4DL	2,144	
Baldwin Co.	W4JOV	1,461	
Shelby Co.	KN4DLV	1,220	
Madison Co.	KK5H	836	
Perry Co.	N4EJF	762	
Tuscaloosa	WS4I	618	
Cleburn Co.	W4AUB	302	
Morgan Co	KN4MDE	99	
Georgia			962
Hospitals in Georgia	K4SDJ	602	
NW Georgia	KK4NTC	151	
Hall Co.	KN4NZK	110	
Gwinnett Co.	W4IGE	99	
Southern Florida			237
Brevard Co.	KL7CW	237	
Southwestern Division			
Arizona			286
Cochise Co.	N7INK	286	
West Gulf Division			
North Texas			870
District 1	W5GPO	712	
Irving	KA5OZC	130	
Hill Co.	KC5BSI	28	
Oklahoma			428
Tulsa Co.	WB5ANX	428	
South Texas			471
Harris Co.	WB5HJV	292	
Ft. Bend C			

Section/Local Nets

Area/Net Name	Net Mgr	Points	Section Points
Atlantic Division			
Delaware			47
DELMARVA	KB3KYH	47	
Eastern Pennsylvania			125
Wayne Co. Net	WA2CCN	125	
Western New York			412
OCTEN	KA2ZNZ	188	
WDN	KB2YAA	145	
CARES	KC2SFU	79	
Western Pennsylvania			249
Bedford Co. ARS	KA3UDR	145	
Beaver Co. Public Service	N3TN	54	
Central Counties Net	K3CWP	50	
Central Division			
Illinois			67
Lake Co.	K9DRW	67	
Wisconsin			5,107
Dunn Co.	WB9WKO	4,759	
Eau Claire Co. ARES/RACES	K9NY	192	
NW District	N9CHA	156	

Area/Net Name	Net Mgr	Points	Section Points
Delta Division			
Arkansas			130
Cross Co. ARES/RACES	W5WPN	90	
Crowley's Ridge ARC	NI5A	40	
Mississippi			5,247
Mississippi SET Net	AA1NA	5,177	
Mississippi HF SET Net	KC5IIW	70	
Great Lakes Division			
Michigan			251
Monroe Co. ARPSC	KE8BYC	162	
Saginaw Valley	KC8YVF	89	
Ohio			924
Central OH Traffic Net	KD8TTE	355	
OSSBN	KC8WH	337	
Liking Co.	KD8SCL	142	
Shelby Co.	KD8RLF	90	
Hudson Division			
New York City-Long Island			139
Nassau Co. ARES/RACES	KD2GXL	139	

Area/Net Name	Net Mgr	Points	Section Points
Midwest Division			
Iowa			74
Cedar Co. ARES	KØWLC	40	
Iowa WARN ARES	KDØQ	34	
Missouri			216
Central MO Emergency	NØAXZ	110	
Jackson Co. ARES Net	KØUAA	106	
New England Division			
Connecticut			312
HF Digi, District 5	W1DJW	69	
Region 2 Tactical Net	WA1SFH	58	
WesConn	KB1NMO	58	
W1FMC	N1DID	42	
ARES District 5	KB1TOR	38	
WR1Z Roxbury	WR1Z	28	
Litchfield Co.	KA1WPM	19	
Pacific Division			
Santa Clara Valley			58
SC4ARES	N6QAD	58	

Area/Net Name	Net Mgr	Points	Section Points
Southeastern Division			
Alabama			3,659
Jefferson Co.	WX4RON	960	
Bibb Co. ARES	K4RKY	862	
Calhoun Co.	AE4BL	820	
Baldwin Co. ARES	WB4EMA	281	
AEN Uniform	WS4I	263	
Bibb HT Net	K4DL	162	
Bibb Simplex Net	K4RKY	144	
Perry Co. ARES	N4EJF	122	
Morgan Co. ARES	KN4MDE	45	
Georgia			343
Georgia Hospital Net	K4SDJ	118	
GEMA	KK4NTC	96	
Gwinnett Co.	KK4WOG	81	
Hall ARES VHF Net	KN4NZK	48	
West Gulf Division			
North Texas			70
Irving RACES/ARES	KA5OZC	70	
South Texas			536
NW Harris Co.	K5SEK	129	
SE Harris Co.	WB5TAD	114	
KD5DX	WD5H	102	
SW Harris Co.	KG5OFB	94	
D14 Harris Co.	W5LDK	59	
PARATUS	K5GOL	38	

Rick Lindquist, WW1ME, ww1me@arrl.org

ARRL Announces New Life 70+ Membership

The ARRL Board of Directors has created a special Life Membership opportunity for individuals who are at least 70 years old. The Life 70+ Membership is available to individuals who have turned 70 and have a combined 25 years of paid annual ARRL membership.

Life 70+ Members receive all benefits of an annual membership, including their choice of print magazine delivery (*QST* or *On the Air*), and digital access to these publications, plus the digital editions of *QEX* and *National Contest Journal* (*NCJ*).

To apply for Life 70+ Membership, individuals must complete the special Life 70+ Member application and submit proof of date of birth, if this information is not already on file with ARRL. The Life 70+ Membership fee must be made in a single payment. Past membership dues payments do not apply, but credit will be applied for applicants who paid their dues in full between April 1 and May 31, 2020.

Life 70+ Membership Dues Rates

$750 | US Life 70+ Membership

$750 | International Digital Life 70+ Membership

$1,515 | International Life 70+ Membership with a Print Subscription

$250 | Family Life 70+ Membership as an add-on to a paid Life 70+ Membership

Download the Life 70+ Membership application at **arrl.org/membership-levels**.

FCC Providing Flexibility to Volunteer Examiners in Developing Remote Testing Methods

The FCC has clarified that nothing in its rules prohibits remote amateur radio testing, and no prior approval is needed to conduct remote exam sessions.

"The Commission provides flexibility to volunteer examiners and coordinators who wish to develop remote testing methods or to increase remote testing programs already in place," the FCC said in an April 30 news release. "We recognize that some volunteer examiner coordinators (VECs) may not have the immediate capacity for widespread remote testing. We expect those volunteer examiner coordinators with limited remote testing capacity to work closely with those requesting such testing to prioritize any available remote testing slots."

In a tweet the next day, FCC Chairman Ajit Pai called the announcement "good news for aspiring amateur radio operators."

The FCC opened the door to remotely administered examinations in a June 5, 2014, FCC *Report and Order*, noting that, since the Volunteer Examiner (VE) system was established, "remote testing methods have been developed, including audio and video links, either hardwired to a site or available through internet or satellite technologies, which would allow a VE team to observe an examinee from afar." While allowing VEs and VECs the option of administering examinations remotely, the FCC declined to incorporate any specific requirements or conditions into the rules and made it clear that VECs and VEs were not required to offer remote testing.

ARRL Volunteer Examiner Coordinator Manager Maria Somma, AB1FM, said she's gratified to see that the FCC appreciates the need for remote testing. "Many of our VEs and VE teams have been employing remotely proctored exam sessions with both video and in-person components, and following social-distancing protocols, where necessary," she said. "Some ARRL VE teams have shown great promise in administering exams remotely."

Somma also said that as states continue to lift restrictions, the possibility exists to restart in-person amateur radio exam opportunities. "Our volunteers should use their best judgement when deciding whether or not to begin conducting in-person exam sessions," she said.

FCC Adopts a New Official Seal

The FCC has redesigned its official seal. The winning design was selected by a vote of the agency's employees and contractors. The revised design incorporates several elements: communications technologies currently transforming our world; four stars on the outer seal border, drawing from the legacy of the predecessor Federal Radio Commission seal; 18 stars on the shield, recognizing the current number of bureaus and offices, and the eagle and shield, identifying the FCC as a federal government agency.

The FCC will incorporate the new seal on official stationery, business cards, publications, and other materials, including on its website and throughout its new headquarters. Official use of the new seal will begin following completion of the agency's move to its new headquarters. The date of the move is delayed due to COVID-19. — *FCC news release*

ARRL Seeks Clarification of Amended Amateur Service RF Safety Rules

ARRL filed a *Petition for Clarification* with the FCC on May 8 to address two issues arising from amended FCC RF safety rules that went into effect on June 1 for the Amateur Radio Service and other FCC-regulated services. Licensees have until May 31, 2022, to determine if an RF safety evaluation is now required under the new rules and to perform an evaluation and implement any needed mitigation measures. Current rules already require amateur stations to meet RF exposure limits, but more radio amateurs will have to evaluate their stations under the new rules. The revised final rules were adopted last November.

"For applicants and licensees in the Amateur Radio Service, we substitute our general exemption criteria for the specific exemption from routine evaluation based on power alone in §97.13(c)(1) and specify the use of occupational/controlled limits for amateurs where appropriate," the FCC said.

ARRL asked the FCC to clarify that using maximum permissible exposure (MPE) limits be permitted in the Amateur Radio Service for required RF safety evaluations of 2,200-meter operations, just as they are elsewhere in the amateur spectrum. Removal of the exemption for amateurs resulted in a requirement to use specific absorption rate (SAR) limits for amateur frequencies between 100 and 300 kHz.

"Near-field calculation of a uniform field applied to a transmitter and antenna operating at 1 W EIRP on 2,200 meters would result in a very conservative estimate of specific absorption rate (SAR) and is a valid measurement for determining safety of operation," ARRL told the FCC. "We request clarification that the rules do not intend to preclude the use of MPE as a surrogate for SAR to evaluate amateur operations in the 2,200-meter band."

ARRL also wants the FCC to clarify that its amended rules permit the use of near-field regression rates, using the MPE table to compare against the maximum field strength that may occur from a handheld portable device, instead of using the SAR. In its filing, ARRL maintained that SAR data is not available for amateur equipment as it is for equipment used in other services. Before the rules were amended, mobile and portable transmitters generally were exempt from the requirement to perform routine environmental evaluations.

Under §97.13(c)(1) as amended, amateur licensees must ensure compliance with FCC RF exposure requirements spelled out in sections 1.1307(b), 2.1091, and 2.1093 of the FCC rules, where applicable. The rule directs radio amateurs to OET Bulletin 65, Supplement B for methodologies and guidance to evaluate amateur radio operation.

The FCC did not amend the actual RF exposure limits adopted in 1996.

Emergency Ventilator Designed and Constructed by Hams Goes to FDA

Radio amateurs have succeeded in providing a complete, working ventilator to University of Florida researchers who, in April, were in the process of applying to the Food and Drug Administration (FDA) for an Emergency Use Authorization (EUA). A successful submission would blaze the way for volunteers and manufacturers around the world to create low-cost, highly functional Intensive Care Unit (ICU) or anesthesia-care ventilators that offer many of the features of modern ventilators at a fraction of the typical cost. Dr. Gordon Gibby, KX4Z, who is associated with

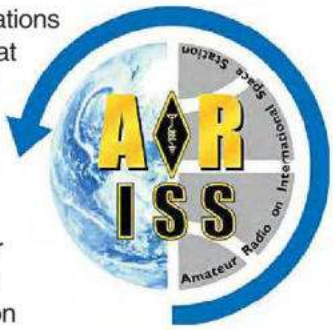
The ventilator controller circuit board, designed by Michael Stapleton, WD4LHT. [Photo courtesy of Gordon Gibby, KX4Z]

the project, said efforts to further improve the device are ongoing.

The completed prototype in Florida was built using typical tools, with assembled boards provided by LifeMech, a manufacturer working with the project.

ARISS Experiments with "Multipoint Telebridge" Approach

Amateur Radio on the International Space Station (ARISS) adopted a concept it's calling the "multipoint telebridge contact via amateur radio" that will allow stay-at-home students to take part in amateur radio contacts with members of the space station crew.



ARISS has used telebridge stations in the past to enable contacts at times when the ISS orbit does not pass overhead to permit a direct radio contact with the school or other location. In a conventional ARISS telebridge contact, an amateur radio ground station in a favorable location for an ISS pass on the scheduled day makes the contact and handles two-way audio via telephone between the station and the contact site. ARISS said its new multipoint telebridge approach permits simultaneous reception by families, school faculty, and the public.

"During the last several weeks, efforts to contain the spread of COVID-19 have resulted in massive school closures worldwide," ARISS said in a late April news release. "In addition, the stay-at-home policies invoked by authorities initially shut down opportunities for ARISS school contacts for the near future."

The inaugural multipoint telebridge contact on April 30 involved 5- to 10-year-old pupils in northern Virginia. Fred Kemmerer, AB1OC, in Hollis, New Hampshire, who served as the telebridge ground station, linked with an ISS crew member via radio. Homebound students and their teacher were able to take part individually via the telebridge network. Under the teacher's direction, each at-home student was to take a turn to ask the astronaut one question on a prepared list, although unrelated technical issues aboard the ISS curtailed the contact. A second contact with students in Canada was very successful, however.

"This approach is a huge pivot for ARISS, but we feel it is a great strategic move," said ARISS-International Chair Frank Bauer, KA3HDO. "In these times of isolation due to the virus, these ARISS connections provide a fantastic psychological boost to students, families, educators, and the public."

Section Manager Nomination Notice

To all ARRL members in Eastern Massachusetts, Missouri, Nebraska, New York City-Long Island, Northern New York, South Carolina, Southern New Jersey, Western Pennsylvania, and West Central Florida: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the Sections concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at **www.arrl.org/section-terms-nomination-information**. Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Field Services Manager, the original documents are received by the Manager within 7 days of the request.

We suggest the following format:

(Place and Date)

Field Services Manager, ARRL
225 Main St.
Newington, CT 06111

We, the undersigned full members of the _____ ARRL Section of the _____ Division, hereby nominate _____ as candidate for Section Manager of this Section for the next 2-year term of office.

(Signature ____ Call Sign_____ City ___ ZIP____)

Any candidate for the office of Section Manager must be a resident of the Section, an amateur radio licensee of Technician class or higher and a full member of ARRL for a continuous term of at least 2 years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on September 4, 2020. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than October 1, 2020, to full members of record as of September 4, 2020 which is the closing date for nominations. Returns will be counted November 24, 2020. Section Managers elected as a result of the above procedure will take office October 1, 2020.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 2-year term beginning January 1, 2021. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the January *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. A Section Manager vacancy occurring between elections is filled through appointment by the Field Services Manager. — *Bart Jahnke, W9JJ, Field Services & Radiosport Department Manager*

Call for Nominations for ARRL Director and Vice Director

Attention to full ARRL members in the Atlantic, Dakota, Delta, Great Lakes, and Midwest Divisions. You have the opportunity to choose a Director and a Vice Director to represent you for 3-year terms beginning January 1, 2021.

ARRL is governed by its Board of Directors. A voting Director is chosen by ballot by the full (licensed) ARRL members in each of its 15 Divisions. Vice Directors, who serve in the absence of the Director at a Board meeting and succeed to the position of Director should a vacancy occur, are chosen at the same time. Elections are held in five Divisions per year. It only takes 10 full members in a Division to nominate a candidate for either office.

Qualifications

The eligibility of nominees for the positions of ARRL Director and Vice Director will be reviewed by the Ethics & Elections Committee, composed of three Directors not subject to election this year: Fred Hopengarten, KIVR; Michael Ritz, W7VO, and Jeff Ryan, KØRM. A nominee must be at least 21 years old and must have been licensed and a full member of ARRL for a continuous term of at least 4 years immediately preceding nomination. Each nominee must provide information concerning their employment, ownership, and investment interests, and other financial arrangements to ensure compliance with the Conflict of Interest Policy (see Article 12 of the ARRL *Articles of Association and Bylaw* 45, available at **www.arrl.org/general-information**). The qualifications for Director and Vice Director are identical. All the powers of the Director are transferred to the Vice Director in the event of the Director's death, resignation, recall, removal outside the Division, or inability to serve.

Nomination Procedure

Step 1: Obtain official nominating petition forms. Any full member residing in a Division where there is an election may request an official nominating petition package in writing, either by letter or via email to **ceo@arrl.org**. The request must reach the ARRL Secretary *no later than noon EDT on Friday, August 14, 2020*. If you are seriously considering running or nominating someone to run, please don't wait until the last minute to request the forms; the deadline for submitting a completed petition form is just 1 week later.

Step 2: Obtain signatures and complete questionnaire. **Only the official form may be used**. The petition form has two sides. To be valid, a nominating petition must name the candidate and must bear the signatures of 10 full members of the Division. The candidate must complete the other side, providing the information required to determine eligibility, certifying its accuracy, and agreeing to assume the office if elected.

Step 3: Submit petition form. The completed form must reach the Secretary *no later than noon EDT on Friday, August 21, 2020*. The submission may be made by electronic transmission of images (i.e., a PDF or JPEG attachment to an email) or facsimile provided that, upon request, the original documents are received by the Secretary within 7 days of the request. A person who is nominated for both Director and Vice Director may choose to decline the nomination for Director; otherwise the nomination for Director will stand and that for Vice Director will be void.

On Monday, August 24, 2020, the Secretary will notify each candidate of the name and call sign of each other candidate for the same office. Candidates will then have until Friday, September 4, 2020 to submit a 300-word statement and a photograph, if they desire these to accompany the ballot, in accordance with instructions that will be supplied.

Balloting

If there is only one eligible candidate for an office, he or she will be declared elected by the Ethics & Elections Committee. If there is more than one eligible candidate for an office, the full members in that Division who are in good standing as of September 10, 2020 will have the opportunity to cast ballots. Official paper ballots and candidates' statements will be mailed to members who are eligible to vote no later than October 1, 2020. Completed ballots must be received at the designated PO Box in the envelope provided by noon Eastern time on Friday, November 20, 2020. The candidate receiving the most votes will be declared the winner.

Absentee Ballots

A full member who is residing temporarily outside his or her home Division, including overseas, may arrange to vote in the home Division by notifying the Secretary prior to September 10, 2020, giving their current mailing address as reflected in the ARRL membership records (i.e. *QST* mailing address) and the reason why another Division is considered home. Members with overseas military addresses should take special note of this provision; in the absence of information received to the contrary, ballots will be sent to them based on their postal addresses.

The Incumbents

The incumbent Directors and Vice Directors, respectively, in the five Divisions in which elections will be held this year are:

Atlantic: Tom Abernethy, W3TOM, Director, and Bob Famiglio, K3RF, Vice Director

Dakota: Matt Holden, KØBBC, Director, and Lynn Nelson, WØND, Vice Director

Delta: David Norris, K5UZ, Director, and Ed Hudgens, WB4RHQ, Vice Director

Great Lakes: Dale Williams, WA8EFK, Director, and Thomas Delaney, W8WTD, Vice Director

Midwest: Rod Blocksome, KØDAS, Director, and Art Zygielbaum, KØAIZ, Vice Director

For the Board of Directors:
May 12, 2020

Barry Shelley, N1VXY, Secretary/Interim Chief Executive Officer

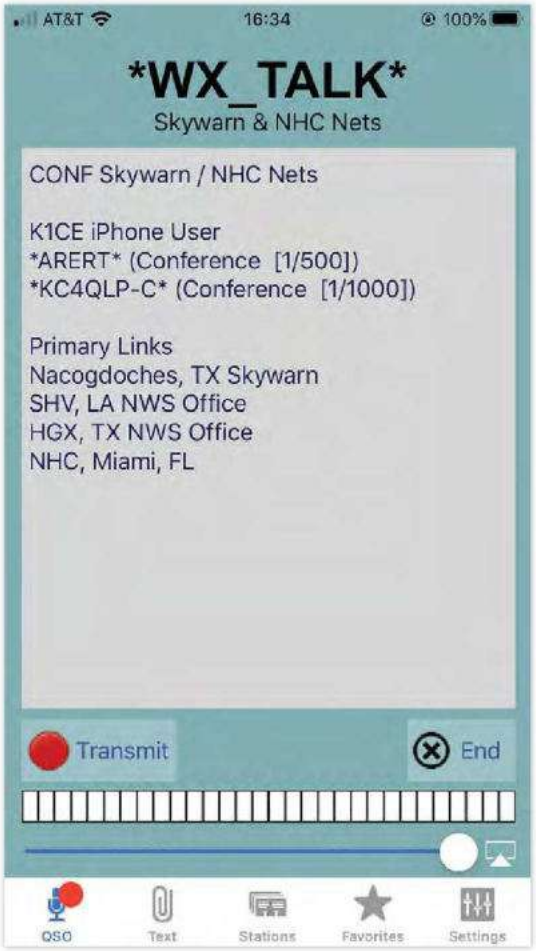
Rick Palm, K1CE, k1ce@arrl.net

Public Service

Getting Started with *EchoLink* — A Time-Tested VoIP Software

After moving to Florida from the northeast, I missed chatting with my friends on my old home repeaters. *EchoLink*® allowed me to connect to the repeaters with my PC, as well as my iPhone via the iOS app (the app is also available for Android devices).

Additionally, after years of monitoring the major hurricane nets during hurricane season on the HF bands, I was able to check in to the conference mode on *EchoLink*, specifically the WX-TALK conference group. This group focuses on SKYWARN® and National Hurricane Center-associated support groups such as the Voice over Internet Protocol (VoIP) Hurricane Net, managed by award-winning ARRL Eastern Massachusetts Section Emergency Coordinator Rob Macedo, KD1CY.



A screenshot of the *EchoLink* conference group, WX-TALK, using the iOS app.

How It Works

EchoLink is a computer software program and phone app that allows licensed amateur radio operators to communicate with one another over the internet using streaming audio with global connections available between stations, through computers, smartphones, or radios to validated user stations. It's not a digital mode, rather it's an FM-based VoIP system.

More than 200,000 validated users are aboard in 151 countries, with some 6,000 stations connected at any one time. Users can connect to participating repeaters, chat with individual and linked stations, and check into nets (conference modes like WX-TALK). You can also enter Dual-Tone Multi-Frequency (DTMF) commands from your radio to access the network.

The software was developed by Jonathan Taylor, K1RFD, nearly 20 years ago, gaining popularity almost instantly. The app can be downloaded for free via your smartphone, or with your Windows operating system at **www.echolink.org**. A user's call sign must be verified via the FCC database before connections are allowed, to deter non-licensees from accessing the network.

Tips for Use

The *EchoLink* platform maintains the catalog of network member-linked and user stations, repeaters, and conferences, and shows which ones are available or busy. Click on or tap the call sign or conference to connect. If the channel is not busy, put out a call to the station operator or repeater: "This is W4UFL, Gainesville, Florida, via *EchoLink*, listening for any station on the repeater." (You need to hesitate about 2 seconds before speaking to compensate for the delay.) Some individual stations may have their laptop connected to their desktop radio that can serve as an RF relay to a handheld transceiver or mobile rig.

In addition to setting up the software, you may need to adjust your sound card audio input and output control settings in Windows. You can use the *EchoLink* Test Server to check your levels. Transmit a brief test message, disengage transmit, and the server will play back your audio. A **PREFERENCES** box provides for selection of the security options, allowing users to choose which types of stations to allow connections — repeaters, links, users — and set banned call signs, which will not be allowed access. Other security mea-

sures include blocking or accepting connections with certain international call sign prefixes for compliance with reciprocal operating privileges or third-party traffic restrictions.

Other real-time data boxes pop up with statistics and station activity summaries of all stations by type, country, and whether they're busy or free. A recording function allows users to record and play back their contacts.

You can also use a text chat feature to send messages to other stations or net control. Some nets, such as the VoIP Hurricane net, will take check-ins from the text box in addition to regular voice check-ins. Nets that run on *EchoLink* operate similar to regular nets, with a few exceptions. First, there may be many repeaters linked into the net via *Echolink* and/or the Internet Radio Linking Project (IRLP). This means that the net control station should allow time for repeaters to connect and minimize announcements, IDs, tones, and other sounds that may interrupt the net. Individuals checking in should also wait a few seconds to speak after keying, due to the slight delay. They should also keep in mind that they too are heard across the conference node and all linked repeaters — a national, and perhaps international, reach.

Net control stations should also keep in mind that check-ins may come from all over the world, so there are a few things net control can do to make life easier. First, break up the check-ins by call area. For example, you can break them up into US stations in call areas 1 – 3, 4 – 6, and 7 – 0, followed by international stations, etc. You may also want to break up stations by function — net managers, National Weather Service (NWS) offices, emergency coordinators, etc. You may hear stations not familiar to you, so it's important to remind everyone to speak clearly and use international phonetics.

Vanity Node Numbers and Financial Support

EchoLink is run by volunteers and is free for its users. To help cover the costs of hardware, software, and internet access required to keep it running, the administrators offer an optional Vanity Node Number program. Normally assigned a six-digit node number, users can have four- or five-digit node numbers that are currently unassigned, for a small financial contribution.

Resources

ARRL published the second edition of *VoIP: Internet Linking for Radio Amateurs*, which discusses *EchoLink*. The book is designed for beginners who need information on how to get started, set up, and use it. It also provides plenty of technical information for those who want to dig deeper into VoIP applications and discover how they work. The book is available from the ARRL Store at **www.arrl.org/shop/VoIP-Internet-Linking-for-Radio-Amateurs**.

Special thanks to Mike Corey, KI1U, Professor of Emergency Management at the University of Mississippi, for his review of the Public Service column.

Field Organization Reports

April 2020

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program can be found at **www.arrl.org/public-service-honor-roll**.

1,200
N9LQF

1,000
K9LJB

650
W9ABS

615
KD8TTE

580
WB9QPM

567
W7PAT

546
WA9APQ

435
WA3EZN

430
N9VC

350
W9KXQ

320
ND8W

275
KE8BYC

260
KT2D

255
WA2CCN

233
AD8CM

220
KK4PUX

219
WA7PTM

215
WS6P
AC9OR
W9UXZ

214
W9PFD

190
W8DJG

189
KD2LPM

180
W4DNA

177
KA9QKH

175
WA9YXK

165
W2PH

160
K0RCJ

156
WD8USA

155
WM2C
W9GRG
N7IE

150
K0RCJ
K0IBS
WB9WKO
KY2MMM

145
W4CMH
WO2H

144
AL0Y

140
AI9F
K4IWW
KK3F

139
KB3KYH

135
KD9GMP
N3KRX
AG9G
K9ILJ
N1LL
N8SY
W3YVQ
AC0KQ

133
K1REZ

130
N2JBA
KC9LSM
K9LGU
W0LAW
KC8WH
W3GWM
KW1U
NA7G

125
KA9MZJ
K4VWK
N5MKY
K8RDN
KB3YRU

124
WA2BSS

120
WA4VGZ
W4NWT
K3JL
N2WGF
KA9QWC
KY2D
WK4WC
W0PZD
KA2ZNZ

117
KA8ZGY
K8AMH

115
AD4DO
KD8ZCM
N1TF

114
WB8YYS
K3FAZ

113
K2TV

110
W2PAX
KO4OL
W1KX
KC9FXE
WB8YLO
K6HTN
KA5AZK
KF5IOU
WB8TQZ
KW9EMG
K3IN
WA3QLW
W1RVY
N1IQI
KD2JKV
AA7BM
K2RMF
KD2IWN
N2LJM

108
N3SW

103
N3RB

101
W9EEU
NI2W

KI7TIG

100
KB9TZS
NN7H
WB4RJW
KZ8Q
KN9P
NX9K
N8CJS
K3RC
AC8RV
WB8SIQ
AC8NP
KE5YTA
KG5NNA
KA2GQQ
KB2QO
KE8KOC
KB8RCR
WB3FTQ
AA3SB
KE1ML
KB2YAA

98
W7PHX

97
AD3J

94
K9DUR

93
KV8Z
W7EES
K0FBS

91
K8MDA
N2DW

90
KM4WHO
WD8DHC
AB9ZA
K8KRA
KB8HJJ
KA1G
WB2VUF
WB8WKQ
KB0DTI
W4TTO
K3MIY
N1LAH
KC1KVY
WA1LPM
WD0BFO

88
N6IET
K1HEJ

87
K6JT
KA0DBK

86
KT4WX
W4INK
NB0Z
KF7GC

85
KL7RF
K1XFC
KB1NAL

84
WB7OSC
W9BGJ
AA3N

83
N2TSO
K1STM
KB1NMO
KC1HHO

82
KB0DTI
KN4AAG

81
KC7ASA

80
K9BFE
KD8UUB
N8MRS
K8ED
KJ7BHO
KA2JFU

79
WB8R
AB3WG

78
W3CJD

76
W2CTG
W8IM
W5XX

74
KA2HZP
WW3S

72
N8OYY
KD2MEN
N3JET

71
K6RAU
W3ZR

70
W9ATV
W9FE
KB9VRW
KG7QWR

The following stations qualified for PSHR in previous months but were not reported in this column: (Mar.) K9SCA 914, WB9QPM 190, N1LL 150, WB4ZIQ 120, KA9QWC 120, KA9MZJ 110, WF2Y 105, W9EEU 95, K9DUR 94, AB9ZA 90, W9BGJ 86, WS4P 78.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AR, AZ, CO, CT, DE, EMA, ENY, EPA, IL, IN, KS, KY, LAX, MDC, ME, MI, MN, MS, NC, NE, NFL, NLI, NM, NNJ, NTX, NV, OH, OR, SFL, SJV, TN, UT, VA, WCF, WMA, WI, WNY, WPA, WTX, WV, WY.

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: AR, CT, DE, ENY, EWA, GA, IA, ID, IL, IN, LA, MDC, MI, MN, MS, NFL, NLI, NM, NNJ, NNY, NV, OH, OR, PAC, SD, SFL, SJV, SNJ, STX, SV, TN, VA, VI, VT, WPA, WTX, WV, WY.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada, and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

KK3F 2,499, NX9K 1,176, WB9WKO 875, N1IQI 629, KW1U 586, K6HTN 547.

Rick Lindquist, WW1ME, ww1me@arrl.org

Amateur Radio World

Amateur Radio Gains Significant Boost in UK by Connecting People During Lockdown

An April BBC news feature outlined how ham radio has gotten a significant boost by connecting people during the COVID-19 lockdown in the UK. The article, by Vanessa Pearce, quotes the Radio Society of Great Britain (RSGB) — the UK's International Amateur Radio Union (IARU) member-society — as saying that many former hams are now returning to the hobby.

Mark Rider, G3VHJ, a retired engineer who lives alone in North Warwickshire, said that during the lockdown restrictions, he decided to dust off his ham radio equipment "to seek out some other social interaction." Rider said that ragchewing has become one of the highlights of his day.

RSGB General Manager Steve Thomas, M1ACB, said the society has experienced a three-fold increase in license examination applications since social distancing rules were put into place. The UK has about 75,000 amateur licensees.

Eleven-year-old Anne-Marie Rowland, 2E0RUX, of Cornwall, worked with the Cornish Amateur Radio Club to conduct informal twice-weekly nets to help keep people in touch. "We have some regulars, but also some new people join in," she told the BBC. Her father, Bill, M0NXF, runs a net that has attracted older radio amateurs who are self-isolating, to help them feel connected.

The RSGB recently instituted its "Get on the Air to Care" (#GOTA2C) campaign in conjunction with the National Health Service (NHS) and its GB1NHS amateur station to promote amateur radio use during the pandemic lockdown. Some stations have been adding "/NHS" to their call signs to encourage the effort, which aims to support the emotional health and well-being of the amateur radio community.

▶ Mark Rider, G3VHJ.

▼ Ann-Marie Rowland, 2E0RUX.

The RSGB introduced remote administration of entry-level Foundation-class amateur radio exams in mid-April. Pete Sipple, M0PSX, told BBC News that he's seen a "massive" surge in demand for training courses and exam sessions and has had to up the number of course offerings.

Hams in India Provide Communication Assistance During COVID-19 Pandemic

According to an April 13 report in *The New Indian Express*, amateur radio operators in Kerala, India, have joined the fight against COVID-19. The newspaper said the district administration has enlisted radio amateurs to improve important communication between departments and offices. Over 20 hams, organized into teams, are involved. Radio Amateur Society of Ananthapuri (RASA) President Dr. Zakheer Hussain, VU3OOH, said using ham radio during the time of crisis would help coordinate crucial communication.

Hussain said help lines receive many calls, including distress calls. "If anyone is in need of emergency medical care, we immediately inform the respective taluk [administrative subdivision] office and the ambulance desk, so that help reaches in time," he said.

The *Times of India* reported on April 17 that a radio amateur in West Bengal drove 98 kilometers (61 miles) to deliver medicine to an elderly resident of Rahara.

The Telegraph newspaper in India reported an anecdote regarding a homeless woman who showed up when Swaraj Ghosh, VU3URP, was distributing food for people on the streets. He contacted Raju Biswas, VU2JF, the secretary of the West Bengal Radio Club, who, in turn, got in touch with radio amateurs in the woman's hometown. They were able to contact her father, who had been looking for her.

Maria Somma, AB1FM, ab1fm@arrl.org

Exam Info

New Amateur Extra-Class Question Pool

On July 1, 2020, the new 2020 – 2024 Amateur Extra-class question pool takes effect for examinations. Volunteer Examiner Coordinators (VECs) and Volunteer Examiners (VEs) must have new Element 4 Extra-class test designs available for use at exam sessions effective that date.

The new question pool released in January 2020 (re-released in February and again in March with minor updates) by the Question Pool Committee (QPC) of the National Conference of Volunteer Examiner Coordinators (NCVEC) incorporates significant changes compared to the current 2016 – 2020 question pool, which expires on June 30, 2020.

The number of questions in the pool was reduced from 712 to 622. The result was 239 modified questions, 49 new questions, and 139 questions removed due to an abundance of outdated questions. Areas of new technology and subjects were added. The 2020 pool has 10 diagrams, which have been renumbered because it has two fewer than the 2016 question pool.

It's important to note that question E3B08 was withdrawn from the new pool and may not be used on exams. Questions in that section were not renumbered, leaving 11 questions.

To view all three question pools, visit the NCVEC website at **www.ncvec.org**.

New Amateur Extra-Class Exams

With the Amateur Extra-class examination questions changing July 1, 2020, new test designs must be used effective that day. Previously supplied ARRL VEC Extra-class exam booklet versions (2016 series) and computer-generated Extra-class exams created from the 2016 question pool are only valid until midnight June 30, 2020. At that time, VE team leaders may dispose of the old versions of the Extra-class exams (do not return them to VEC). To avoid confusion at the session, do not save old exam versions.

ARRL VE Exam Maker Software (**www.arrl.org/ve-exam-maker-software**) has been updated with the new Amateur Extra-class question pool and is available for generating new exam versions.

ARRL VEC will supply its officially appointed Field-Stocked VE teams with new exam booklet designs. An updated package will not be provided to field-stocked teams that no longer meet the field stock requirements, have not conducted a session in the past year, or have been keeping supplies without qualifying through the VEC. Non-stocked VE teams should be returning their exam packages and supplies to ARRL VEC after each session is completed.

The ARRL VEC VE Resources page (**www.arrl.org/resources-for-ves)** offers information needed to help conduct exam session business. Our support page offers easy access to exam forms and information, question pools, FCC rules, basic qualification question information, and more.

Question Pool Schedule

The three current question pools (and any exam designs based on these question pools) are valid as follows:

Technician-class (Element 2) pool effective July 1, 2018 is valid until June 30, 2022.
- Questions withdrawn from use: none.

General-class (Element 3) pool effective July 1, 2019 is valid until June 30, 2023.
- Questions withdrawn from use: none.

Amateur Extra-class (Element 4) pool effective July 1, 2020 is valid until June 30, 2024.
- Questions withdrawn from use: E3B08 deleted from pool.

Each question pool is reviewed and updated on a 4-year rotation. No question pools will be updated or released in 2021.

Compare FCC Results Through April

COVID-19 has significantly affected amateur radio testing.

New amateur radio licenses issued are down by 24% and upgraded licenses are down by 39% over the same period last year.

Hopefully, as life begins to return to some normalcy, exam session opportunities will resume and increase in frequency.

FCC Results Through April

FCC License Action	2019	2020	% Change
New licenses	10,843	8,277	–24%
Upgraded licenses	3,640	2,221	–39%
Total licenses	14,483	10,498	–28%

Bruce Draper, AA5B, aa5b.corral@gmail.com

Contest Corral

July 2020

Check for updates and a downloadable PDF version online at **www.arrl.org/contest-calendar**.
Refer to the contest websites for full rules, scoring information, operating periods or time limits, and log submission information.

Start - Finish Date-Time		Date-Time		Bands	Contest Name	Mode	Exchange	Sponsor's Website
1	0000	1	2359	1.8-144	RAC Canada Day Contest	CW Ph	RS(T), VE province/territory or serial	rac.ca/our-programs
2	1700	2	2100	28	NRAU 10-Meter Activity Contest	CW Ph Dig	RS(T), 6-char grid square	nrau.net/activity-contests
2	1900	2	2100	1.8-50	SKCC Sprint Europe	CW	RST, SPC, name, mbr or power	www.skccgroup.com
4	0000	4	0400	3.5-28	FISTS Summer Slow Speed Sprint	CW	RST, SPC, name, mbr or power	fistsna.org
4	0900	5	0859	3.5	YBDXC 80-Meter Contest	Ph	RS, serial	80m.ybdxcontest.com
4	1100	5	1059	3.5-28	DL-DX RTTY Contest	Dig	RST, serial	www.drcg.de/dldxrtty
4	1400	5	1400	1.8-28	Marconi Memorial HF Contest	CW	RST, serial	arifano.it/contest_marconi.html
4	1500	5	1500	3.5-14	Original QRP Contest	CW	RST, serial, power category	www.qrpcc.de/contestrules
4	2000	5	2000	7	PODXS 070 Club 40-Meter Firecracker Sprint	Dig	RST, SPC	www.podxs070.com
6	0100	6	0300	3.5-28	ARS Spartan Sprint	CW	RST, SPC, power	arsqrp.blogspot.com
6	1900	6	2030	3.5	RSGB 80-Meter Club Championship, CW	CW	RST, serial	www.rsgbcc.org/hf
11	0000	11	0400	3.5-28	FISTS Summer Unlimited Sprint	CW	RST, SPC, name, mbr or power	www.fistsna.org
11	1200	12	1200	1.8-28	IARU HF World Championship	CW Ph	HQ stations: RS(T), IARU Society Others: RS(T), ITU zone	arrl.org/iaru-hf-world-championship
11	1200	12	2359	1.8-50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
12	2000	12	2300	1.8-28	QRP ARCI Summer Homebrew Sprint	CW	RST, SPC, mbr or power	qrparci.org
13	0000	13	0200	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or power	www.4sqrp.com
15	1900	15	2030	3.5	RSGB 80-Meter Club Championship, SSB	Ph	RS, serial	www.rsgbcc.org/hf
16	0030	16	0230	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or power	naqcc.info
18	0700	18	1459	7-28	Russian Radio Team Championship	CW Ph	RS(T), 3-char code or ITU zone	srr.ru/chempionat-rossii-po-radiosvyazi-na-kv-rrtc
18	0800	18	1400	1.8-7	Trans-Tasman Low-Bands Challenge	CW Ph Dig	RS(T), serial	wia.org.au/members/contests
18	1200	18	1359	1.8-50	Feld Hell Sprint	Dig	RST, mbr, SPC, grid	sites.google.com/site/feldhellclub
18	1800	19	0559	3.5-28	North American QSO Party, RTTY	Dig	Name, state/DC/province/country	www.ncjweb.com/naqp
18	1800	19	2100	50, 144	CQ Worldwide VHF Contest	CW Ph Dig	4-char grid square	www.cqww-vhf.com
19	0900	19	1600	3.5-14	RSGB Low Power Contest	CW	RST, serial, power	www.rsgbcc.org/hf
19	1900	19	2359	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or power	qrpcontest.com/pigrun
19	2000	19	2159	14	CQC Great Colorado Gold Rush	CW	RST, SPC	www.coloradoqrpclub.org
22	0000	22	0200	1.8-28	SKCC Sprint	CW	RST, SPC, name, mbr or power	www.skccgroup.com
23	1900	23	2030	3.5	RSGB 80-Meter Club Championship, Data	Dig	RST, serial	www.rsgbcc.org/hf
25	1200	26	1200	3.5-28	RSGB IOTA Contest	CW Ph	RS(T), serial, IOTA number (if applicable)	www.rsgbcc.org/hf
26	1700	26	2100	7-28	ARS Flight of the Bumblebees	CW	RST, SPC, power or bumblebee number	www.arsqrp.blogspot.com
27	1300	27	1400	1.8-28	QCX Challenge	CW	RST, name, SPC, rig	www.qrp-labs.com/party.html
27	1900	27	2000	1.8-28	QCX Challenge	CW	RST, name, SPC, rig	www.qrp-labs.com/party.html
27	1900	27	2030	3.5	RSGB FT4 Contest Series	Dig	4-char grid square	www.rsgbcc.org/hf
28	0300	28	0400	1.8-28	QCX Challenge	CW	RST, name, SPC, rig	www.qrp-labs.com/party.html

All dates refer to UTC and may be different from calendar dates in North America. Contests are not conducted on the 60-, 30-, 17-, or 12-meter bands. Mbr = Membership number. Serial = Sequential number of the contact. SPC = State, Province, DXCC Entity. XE = Mexican state. Listings in blue indicate contests sponsored by ARRL or *NCJ*. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column. *Data for Contest Corral is maintained on the WA7BNM Contest Calendar at* **www.contestcalendar.com** *and is extracted for publication in* QST *2 months prior to the month of the contest. ARRL gratefully acknowledges the support of Bruce Horn, WA7BNM, in providing this service.*

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2019 ARRL 10-Meter Contest Results

The results of the December 14 – 15, 2019 event.

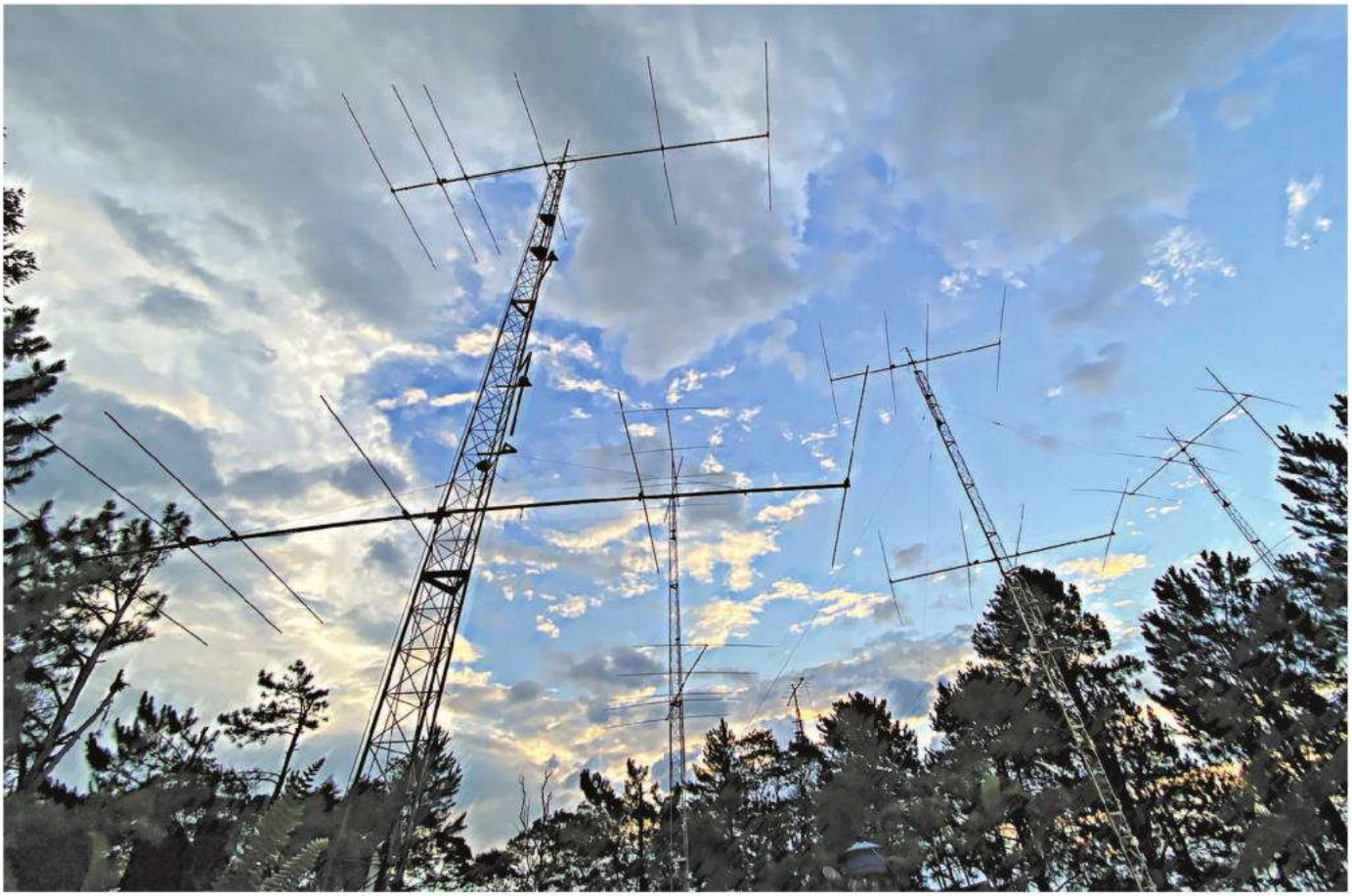
Full Results Online

You can read the full results of the contest online at **http://contests.arrl.org** or **www.arrl.org/contest-results-articles**. You'll find detailed analysis and more play-by-play, along with the full line scores. Improve your results by studying your log-checking report, too.

The 2020 ARRL 10-Meter Contest will be held December 12 – 13, 2020.

Affiliated Club Competition

Club	Score	Entries
Unlimited		
Potomac Valley Radio Club	1,081,788	91
Frankford Radio Club	932,194	62
Minnesota Wireless Assn.	698,328	86
Medium		
Florida Contest Group	1,025,336	43
Yankee Clipper Contest Club	773,484	45
Society of Midwest Contesters	436,064	46
Tennessee Contest Group	229,374	13
Alabama Contest Group	219,262	12
Southern California Contest Club	207,332	27
Northern California Contest Club	201,026	24
Contest Club Ontario	193,900	24
Central Texas DX and Contest Club	180,518	13
Arizona Outlaws Contest Club	150,732	21
Mad River Radio Club	100,782	9
South East Contest Club	94,712	7
Grand Mesa Contesters of Colorado	75,922	12
Kentucky Contest Group	74,680	9
Carolina DX Assn.	73,974	5
Hampden County Radio Assn.	62,856	15
DFW Contest Group	49,426	11
Maritime Contest Club	43,260	3
North Texas Contest Club	41,600	3
Kansas City Contest Club	41,328	5
Mother Lode DX/Contest Club	40,026	12
Northeast Maryland Amateur Radio Contest Society	38,978	6
Hudson Valley Contesters and DXers	36,880	12
Granite State ARA	34,782	7
Texas DX Society	30,754	6
Driftless Zone Contesters	29,826	4
Sussex County ARC	24,728	3
North Coast Contesters	22,656	6
Louisiana Contest Club	21,288	3
Great Places Contest Club	14,932	4
Pacific Northwest VHF Society	13,512	3
Western Washington DX Club	12,720	5
Port Lavaca Amateur Radio Club	12,346	3
Willamette Valley DX Club	10,820	6
Northern Arizona DX Assn.	9,690	4
West Park Radiops	7,120	3
Order of Boiled Owls of New York	6,890	3
Big Sky Contesters	5,766	5
Meriden ARC	5,748	3
Swamp Fox Contest Group	3,240	3
Rochester (NY) DX Assn.	1,518	4
Local		
The Villages Amateur Radio Club	60,668	5
CTRI Contest Group	52,820	6
Niagara Frontier Radiosport	49,712	4
Central Virginia Contest Club	38,706	6
Piedmont Contest Group	3,986	4
Redwood Empire DX Assn.	3,928	3



The PX2A contest station's antenna farm in Brazil, with the stacked beams pointed toward North America. The team scored a second-place finish worldwide in the Mulitoperator, High Power category. [Fernando Cordoba, PY2LED, photo]

Top Ten

US

Single Operator, Mixed Mode, High Power

W0AIH (NE9U, op)	272,048
K0TT	101,808
K1KI	100,224
N4OX	77,352
W1VEM	72,590
K3ZO	63,360
K6AM	58,080
AG4W	47,640
KA9FOX	47,376
W2OIB	45,252

Single Operator, Mixed Mode, Low Power

N8II	53,460
K2PS	40,500
WB8WKQ	19,320
WN6K	18,256
AC0W	17,632
ND9G	10,688
KD5J	9,174
WA8ZBT	8,946
KA8CNI	8,700
K3YDX	7,458

Single Operator, Mixed Mode, QRP

WA6FGV	4,452
WB2AMU	2,808
N4ELM	1,728
ND0C	1,680
K4PZC	1,008
AC6YY	880
K4NAX	648
K1PDY	400
N7VS	324
NT6H	208

Single Operator, Phone Only, High Power

W5PR	19,800
W4DD	19,670
AF1T	14,256
KE2DX	13,920
K5TR (WM5R, op)	13,080
KD7RF	7,562
K8DJR	5,512
N4MM	2,288
KZ4P	1,880
WB4YDY	1,862

Single Operator, Phone Only, Low Power

K4FCG (K1KNQ, op)	6,026
NO2EL	4,320
KB4OLM	3,504
AA2IA	2,520
NF7E	2,046
KM4ODS	1,860
KA1VMG	1,846
W6BS	1,408
K2SDS	1,232
KC3OBS	900

Single Operator, Phone Only, QRP

WE6EZ	532
W6QU (W8QZA, op)	256
W1CEK	42
KF6ZYD	20
AC2N	8
W7BAK	2
K0JWQ	2

Single Operator, CW Only, High Power

K1TO	210,960
K5NA	117,448
W6YX (N7MH, op)	64,768
NY3A	59,136
K1RM	54,880
K4BAI	51,240
NA8V	48,240
N8LJ	39,732
W0ZA	37,000
W1WEF	35,376

Single Operator, CW Only, Low Power

W3BGN	42,000
N5/WP3C	29,260
AC4G	25,584
K1DC	24,500
K1VUT	19,552
K4ORD	18,576
K1TR	18,444
KN4Y	16,640
W1QK	15,264
KN0V	13,500

Single Operator, CW Only, QRP

N5OE	2,856
KH6KG/W5	2,660
N8AP	2,244
N4AU	1,736
KE2SX	1,012
K3TW	800
KZ3I	648
WB2CPU	612
W8IM	600
KU7Y	580

Single Operator Unlimited, Mixed Mode, High Power

N8OO	284,200
WO4O	171,288
N3RD	111,900
K3WW	98,410
N4RV	97,236
K2XR	95,520
W3IP	68,564
W1TJL	66,216
WV4P	56,994
KU2M	42,120

Single Operator Unlimited, Mixed Mode, Low Power

K9OM	102,510
K1ZE	19,018
KE2D	13,184
N5DO	11,832
NU4E	11,160
W4JUU	7,680
KE3K	7,290
W1DYJ	6,292
N1API	5,704
W4EE	5,678

Single Operator Unlimited, Mixed Mode, QRP

N2KW	120

Single Operator Unlimited, Phone Only, High Power

W2RD	5,886
KA1ZD	4,850
AJ4VE	1,296
K9MU	972
N2NKX	700
N3DUE	450
W9KXI	264
AB4KY	220
AD0TA	126
K7STO	102

Single Operator Unlimited, Phone Only, Low Power

K2DRH	10,582
K2ADA	7,222
N2MUN	924
N7MZW	774
W4POT	620
N2ESP	576
KK4ADQ	440
W6IFN	150
N6LB	110
K2ANZ	98

Single Operator Unlimited, Phone Only, QRP

K2GMY	518
WB6BET	28
WA7NWL	2

Single Operator Unlimited, CW Only, High Power

NN7CW	157,872
W3EP	113,490
N4BP	91,728
W1KM	75,432
WW5M	66,364
N2MM	64,768
K3EST	55,088
NR4M	47,236
N6SS	46,872
K5LG	46,812

Single Operator Unlimited, CW Only, Low Power

W9XT	31,096
WT9Q	29,172
N4UA	27,692
K8AJS	20,904
K2DFC	20,592
WA1FCN	18,480
N7YK	12,400
K1XM	10,296
K9IUQ	8,400
N3AC	6,624

Single Operator Unlimited, CW Only, QRP

N0UR	1,248
KN1GUN	928
KI9A	572
W2OL	480
KW2A	120
K0TLG	40
W1VT	12

Multioperator, Single Transmitter, High Power

NV9L	208,754
AA1JD	150,526
N1RR	124,712
NX5M	88,192
W3ZGD	79,278
W8PR	69,836
NX6T	37,168
W4RN	30,912
K3CCR	27,470
K0OO	22,428

Multioperator, Single Transmitter, Low Power

N4SVC	41,076
N1SOH	8,550
W7TVC	7,616
W7PU	3,080
W1NRG	2,128
KI6YYT	848
W4CDA	660
WA1F	336
KB5ZSK	168
AF5Q	84

Canada

Single Operator, Mixed Mode, High Power

VE3KZ	65,130
VA2RF	6,144
VE3BR	936

Single Operator, Mixed Mode, Low Power

VE9ML	1,176
VE3OIL	1,100
VE7ZR	448
VE2NCG	156
VA3UKR	80
VE7BGP	24
VA3EON	4

Single Operator, Mixed Mode, QRP

VE6EX	24

Single Operator, Phone Only, High Power

VA2BN	440
VA3MW	216
VA3PC	50

Single Operator, Phone Only, Low Power

VE3CNA	2

Single Operator, CW Only, High Power

VE3DZ	44,880
VE3PN	8,532
VA7MM	4,356
VE3YAA (VE3FJ, op)	4,352
VE4VT	4,048
VE9OA	3,312
VE3CX	112

Single Operator, CW Only, Low Power

VE3BW	6,656
VE3SST	2,112
VE3ZY	1,196
VA3EC	420
VE3TM	392
VE3AQ	312
VA3WB	160
VA3RKM	156
VE5GC	96
VE6/K0XF	20

Single Operator, CW Only, QRP

VE3CBK	8

Single Operator Unlimited, Mixed Mode, High Power

VE5MX	21,600
VE9CB	19,092
VE3KTB	48

Single Operator Unlimited, Mixed Mode, Low Power

VA3DF	38,076
VE3PJ	1,440
VE3MA	416
VE6SH	104

Single Operator Unlimited, CW Only, High Power

VE9AA	17,112
VE3EJ	13,440
VE2FK	7,040
VE3MM	2,752
VE3NNT	540
VE4GV	120

Single Operator Unlimited, CW Only, Low Power

VA2CZ	10,608
VE1OP	7,056
VE7XT	1,476
VE3FU	1,300
VE3MGY	484
VE6TL	480
VE6JF	192

Mexico

Single Operator, Mixed Mode, Low Power

XE1AY	420
XE1HG	32

Single Operator, Phone Only, Low Power

XE1AO	48
XE1H	24
XE2ML	16

Single Operator, CW Only, High Power

4A5E (XE1EE, op)	312

Single Operator, CW Only, Low Power

XE3A	1,760
XE1CT	1,716
XE2AU	1,508
XE2X	276

Single Operator Unlimited, Mixed Mode, Low Power

XE2B	6,210

Single Operator Unlimited, Phone Only, Low Power

XE2JS	560
XE2N	8

Single Operator Unlimited, CW Only, High Power

XE2S	2,240

DX

Single Operator, Mixed Mode, High Power

OA4SS	42,822
G4FKA	6,102
NP2P (N2TTA, op)	5,544
LZ6E	3,528
VK4SN	2,592
OK2EQ	2,550
HP3SS	2,490
YL2BJ	1,848
LY7Z	1,298
J79WTA	900

Single Operator, Mixed Mode, Low Power

L55D (LU5DF, op)	120,120
LW1D	28,272
LU6FLZ	9,660
HG0R (HA0NAR, op)	9,288
LU7DW (VE3AP, op)	6,014
EA8AQV	5,600
EA8OM	1,800
EA8DHV	1,376
IK4OMO	1,288
JR1MEG/1	1,168

Single Operator, Mixed Mode, QRP

PY2NY	2,812
PY2IAX	760
JR1UJX/2	400
HZ1TT	396
PE2K	128
JH7UJU	56
JH3DMQ	44

Single Operator, Phone Only, High Power

CV7S (CX7SS, op)	48,000
CE6CGX	20,904
FR4QT	12,444
LQ5A	9,040
M6T (G0AEV, op)	7,008
PY5DC	2,432
3G3N	1,720
M2L (M0BJL, op)	726
F5LIW	702
EA2DR	522

Single Operator, Phone Only, Low Power

CA4PSH	21,090
LW4EF	11,160
LU2UG	6,916
PY3EW	3,360
CB4A (CE4UFC, op)	2,600
LT7F (LU6FOV, op)	1,440
PU8YAB	1,430
LU4DPL	1,260
PU2UAF	1,200
PU2PZE	1,128

Single Operator, Phone Only, QRP

TG9ANF	1,650
PA2TMS	378
VK4FOMP	192
PU2RTO	180
I5KAP	168
PY2BN	72
SP7VTQ	70
PU2PNB	60
PU2NZO	60
JA2MWV	36

Single Operator, CW Only, High Power

CE2ML (CX1EK, op)	76,356
CX9AU	67,716
CT1ILT	45,696
PY4DX	38,612
LZ4TX	5,896
EA5FX	5,244
SP2FVN	5,192
UY5ZZ	4,104
OH2PM	2,752
F5VMN	2,496

Single Operator, CW Only, Low Power

LU6DOT	63,720
CB3R (XQ3SK, op)	38,612
PY3XX	19,980
LU7YWC	17,120
V51YJ	15,984
LU8QT	12,720
DL4WA	3,468
EA3NO	2,652
DL9ZP	2,592
EA1DAV	2,256

Single Operator, CW Only, QRP

CX7RL	2,016
JQ1NGT	1,392
EU1AA	1,344
US5VX	648
MØHMJ	612
PU2NBI	468
HA3HX	320
JR1NKN	264
JM1MTE	180
JS1BXH	144

Single Operator Unlimited, Mixed Mode, High Power

DL2ARD	102,346
CE2LR	97,088
CX4SS	27,840
F5NBX	24,840
S51DI	23,368
EA8RM	22,800
PY5ZHP	16,968
HG8W (HA8ZO, op)	16,302
TM5CQ (F4GXX, op)	14,288
ON6NL	10,804

Single Operator Unlimited, Mixed Mode, Low Power

LQ3D	45,952
PY3OZ	25,200
PJ2T (WØCG, op)	24,642
LU6DC	7,524
F8ATS	7,316
LU5DX	6,720
PY8WW	6,048
G4PVM	3,864
IT9CHU	3,520
PE4BAS	2,736

Single Operator Unlimited, Mixed Mode, QRP

EB1RL	4,488
SD6F (SM6JWR, op)	140

Single Operator Unlimited, Phone Only, High Power

LU1DX	33,158
V51WH	12,210
EA7JXZ	4,350
LW3EK	700
EA4TD	486
MMØTFU	400
PY5BH	340
PY2GTA	170
VK4QH	116
PY2GZ	108

Single Operator Unlimited, Phone Only, Low Power

ZV1T (PP1WW, op)	3,480
PY2CP	1,820
PY5FO	1,248
PT7ZT	720
EA4AA	620
PY4BK	444
EA8CNR	250
CE1BF	232
PT7BI	222
PY4GG	184

Single Operator Unlimited, CW Only, High Power

DH8BQA	44,492
HA8FK	12,208
DK9IP	10,560
PA5WT	9,100
S53M (S51FB, op)	9,088
LU5FF	8,848
DL1WA	7,800
VK4CT	7,296
GØORH	6,100
9H1XT	4,940

Single Operator Unlimited, CW Only, Low Power

CX2BR	88,440
LT7D	83,980
PY3DX	23,780
FY5KE (F6FVY, op)	23,780
L33M (LU3MAM, op)	18,240
EA7RM	7,072
LU3JVO	4,508
PY2XC	2,888
D4Z (IK2NCJ, op)	2,584
I2SVA	2,400

Single Operator Unlimited, CW Only, QRP

YT2RX	252
JH1VIX	104
MM3AWD	32
JK1TCV	24
JG1GOY	8
US5EFU	4

Multioperator, Single Transmitter, High Power

LW8DQ	272,748
PX2A	173,196
EA5DY	35,190
LZ5R	22,648
PP5NY	19,504
EE5T	17,860
HI3LT	10,272
PW1F	4,648
JK2VOC	518
DN5HR	66

Multioperator, Single Transmitter, Low Power

LS2D	32,996
PY2UD	26,290
PT5D	17,444
LU1DBQ	13,248
PV2B	2,480
JJ2YDV	144
F4KIY	120
PY2GMR	30
PR7PPS	14

Continental Winners

Africa

Single Operator, Mixed Mode, Low Power	EA8AQV	5,600
Single Operator, Phone Only, High Power	FR4QT	12,444
Single Operator, Phone Only, Low Power	EB8AC	748
Single Operator, CW Only, Low Power	V51YJ	15,984
Single Operator Unlimited, Mixed Mode, High Power	EA8RM	22,800
Single Operator Unlimited, Phone Only, High Power	V51WH	12,210
Single Operator Unlimited, Phone Only, Low Power	EA8CNR	250
Single Operator Unlimited, CW Only, Low Power	D4Z (IK2NCJ, op)	2,584

Asia

Single Operator, Mixed Mode, High Power	TA4CS	360
Single Operator, Mixed Mode, Low Power	JR1MEG/1	1,168
Single Operator, Mixed Mode, QRP	JR1UJX/2	400
Single Operator, Phone Only, High Power	JG2REJ	8
Single Operator, Phone Only, Low Power	JR1AKD/1	36
Single Operator, Phone Only, QRP	JA2MWV	36
Single Operator, CW Only, High Power	4X1VF	1,584
Single Operator, CW Only, Low Power	JJ1LBJ	980
Single Operator, CW Only, QRP	JQ1NGT	1,392
Single Operator Unlimited, Mixed Mode, High Power	JH4UTP	4,386
Single Operator Unlimited, Mixed Mode, Low Power	JH6WHN	1,044
Single Operator Unlimited, CW Only, High Power	7K4VPV	780
Single Operator Unlimited, CW Only, Low Power	JG1XIO	288
Single Operator Unlimited, CW Only, QRP	JH1VIX	104
Multioperator, Single Transmitter, High Power	JK2VOC	518
Multioperator, Single Transmitter, Low Power	JJ2YDV	144

Europe

Single Operator, Mixed Mode, High Power	G4FKA	6,102
Single Operator, Mixed Mode, Low Power	HGØR (HAØNAR, op)	9,288
Single Operator, Mixed Mode, QRP	PE2K	128
Single Operator, Phone Only, High Power	M6T (GØAEV, op)	7,008
Single Operator, Phone Only, Low Power	EA1TI	580
Single Operator, Phone Only, QRP	PA2TMS	378
Single Operator, CW Only, High Power	CT1ILT	45,696
Single Operator, CW Only, Low Power	DL4WA	3,468
Single Operator, CW Only, QRP	EU1AA	1,344
Single Operator Unlimited, Mixed Mode, High Power	DL2ARD	102,346
Single Operator Unlimited, Mixed Mode, Low Power	F8ATS	7,316
Single Operator Unlimited, Mixed Mode, QRP	EB1RL	4,488
Single Operator Unlimited, Phone Only, High Power	EA7JXZ	4,350
Single Operator Unlimited, Phone Only, Low Power	EA4AA	620
Single Operator Unlimited, CW Only, High Power	DH8BQA	44,492
Single Operator Unlimited, CW Only, Low Power	EA7RM	7,072
Single Operator Unlimited, CW Only, QRP	YT2RX	252
Multioperator, Single Transmitter, High Power	EA5DY	35,190
Multioperator, Single Transmitter, Low Power	F4KIY	120

North America

Single Operator, Mixed Mode, High Power	NP2P (N2TTA, op)	5,544
Single Operator, Mixed Mode, Low Power	KP4VP	24
Single Operator, Phone Only, QRP	TG9ANF	1,650
Single Operator, CW Only, Low Power	HP1AC	544
Single Operator, CW Only, QRP	V31MA	16
Single Operator Unlimited, Mixed Mode, High Power	NP2X (K9VV, op)	8,008
Single Operator Unlimited, Mixed Mode, Low Power	ZF2LA	576
Multioperator, Single Transmitter, High Power	HI3LT	10,272

Oceania

Single Operator, Mixed Mode, High Power	VK4SN	2,592
Single Operator, Mixed Mode, Low Power	VK3JA	504
Single Operator, Phone Only, High Power	FK4QX	328
Single Operator, Phone Only, Low Power	VK2NSS	264
Single Operator, Phone Only, QRP	VK4FOMP	192
Single Operator, CW Only, High Power	VK2GR	1,692
Single Operator, CW Only, Low Power	VK2IG	420
Single Operator Unlimited, Mixed Mode, High Power	VK3KTT	312
Single Operator Unlimited, Mixed Mode, Low Power	YC2VOC	52
Single Operator Unlimited, Phone Only, High Power	VK4QH	116
Single Operator Unlimited, Phone Only, Low Power	ZL2MM	24
Single Operator Unlimited, CW Only, High Power	VK4CT	7,296

South America

Single Operator, Mixed Mode, High Power	OA4SS	42,822
Single Operator, Mixed Mode, Low Power	L55D (LU5DF, op)	120,120
Single Operator, Mixed Mode, QRP	PY2NY	2,812
Single Operator, Phone Only, High Power	CV7S (CX7SS, op)	48,000
Single Operator, Phone Only, Low Power	CA4PSH	21,090
Single Operator, Phone Only, QRP	PU2RTO	180
Single Operator, CW Only, High Power	CE2ML (CX1EK, op)	76,356
Single Operator, CW Only, Low Power	LU6DOT	63,720
Single Operator, CW Only, QRP	CX7RL	2,016
Single Operator Unlimited, Mixed Mode, High Power	CE2LR	97,088
Single Operator Unlimited, Mixed Mode, Low Power	LQ3D	45,952
Single Operator Unlimited, Phone Only, High Power	LU1DX	33,158
Single Operator Unlimited, Phone Only, Low Power	ZV1T (PP1WW, op)	3,480
Single Operator Unlimited, CW Only, High Power	LU5FF	8,848
Single Operator Unlimited, CW Only, Low Power	CX2BR	88,440
Multioperator, Single Transmitter, High Power	LW8DQ	272,748
Multioperator, Single Transmitter, Low Power	LS2D	32,996

James Duffey, KK6MC, jamesduffey@comcast.net

2020 ARRL January VHF Contest Results

This year's ARRL January VHF Contest was held January 18 – 20, 2020.

Division Winners

Classic Rover

Atlantic	KF2MR/R	69,936
Central	KA9WBT/R	3,243
Dakota	KC0P/R	624
Delta	AG4V/R	27,740
Northwestern	KE7MSU/R	6,264
Pacific	N6NB/R	290,640
Roanoke	W8BRY/R	190
Southeastern	K4RSV/R	1,248
Southwestern	W6IT/R	36,960
West Gulf	K2EZ/R	110,715
Canada	VE3OIL/R	25,608

Limited Rover

Atlantic	N5BNO/R	4,920
Central	W9YOY/R	2,583
Dakota	N0SPN/R	225
Delta	AE5P/R	14,550
Hudson	WB2SIH/R	7,654
Midwest	KE0MHJ/R	5,074
New England	AF1R/R	1,350
Northwestern	KL7VHF/R	480
Pacific	WB6HUM/R	1,520
Roanoke	KM4OZH/R	3,509
Rocky Mountain	AA5PR/R	1,200
Southeastern	WB8LYJ/R	4,255
Southwestern	N6GP/R	4,181
West Gulf	KA5D/R	28,480
Canada	VO2AC/R	2,660
Canada	VO2AAA/R	2,660

Unlimited Rover

Atlantic	N2SLN/R	2,108
Delta	WD5DJW/R	72
Pacific	K6MI/R	149,684
Southeastern	K4SME/R	6,486
Southwestern	N6ZE/R	10,848
West Gulf	K5SRT/R	126,816
Canada	VE7AFZ/R	1,037

Single Operator, High Power

Atlantic	N2YB	81,962
Central	N9AKR	12,936
Dakota	W0GHZ	6,342
Delta	N4QWZ	41,985
Great Lakes	K8ZR	9,765
Hudson	W2KV	19,620
Midwest	K0TPP	12,054
New England	K1TEO	254,196
Northwestern	K7YDL	10,478
Pacific	K6WIS	4,968
Roanoke	W3IP	22,896
Rocky Mountain	W9RM	4,088
Southeastern	WA4GPM	13,320
Southwestern	N1AV	67,373
West Gulf	K5LLL	26,487
Canada	VE3ZV	47,058

Single Operator, Low Power

Atlantic	N2WK	66,445
Central	K9MU	12,410
Dakota	W0ZQ	4,212
Delta	AA4DD	1,269
Great Lakes	N8LRG	12,483
Hudson	WB2JAY	5,487
Midwest	N0LL	4,368
New England	AF1T	58,740
Northwestern	WZ8T	8,091
Pacific	W6TV (W6YEP, op)	73,710
Roanoke	KT1R	3,597
Rocky Mountain	NJ7A	666
Southeastern	W4RAA	7,093
Southwestern	N7VD	21,840
West Gulf	K5TRA	14,964
Canada	VE3DS	30,876

Single Operator, Portable

Atlantic	KB3SIG	16
Central	K9AA (KO9A, op)	1,080
Delta	NV4B	195
Hudson	N2YTF	782
Midwest	N0JK	28
Northwestern	K7ATN	6,358
Pacific	AA6XA	1,160
Rocky Mountain	K0NR	77
Southwestern	WA7JTM	5,375

Single Operator, Three-Band

Atlantic	AI3Z	4,935
Central	KO9A	14,628
Dakota	K0VG	528
Delta	N4HUF	4,968
Great Lakes	WA8TTM	2,886
Hudson	KA2BPP	600
New England	W1QK	8,960
Northwestern	N7EPD	5,600
Pacific	K7XC	1,326
Roanoke	WA4LDU	1,836
Rocky Mountain	KC7QY	288
Southeastern	AG4W	2,015
Southwestern	N7IR	3,480
West Gulf	KI5YG	1,720
Canada	VE3SST	5,292

Single Operator, FM Only

Atlantic	KB1POP	115
Central	WB9WOZ	996
Dakota	N0HDR	205
Delta	K4NRT	15
Great Lakes	N8PPF	12
Hudson	K2NUD	1,120
Midwest	K0PHP	297
Northwestern	KI7LTT	510
Pacific	W6IA	460
Roanoke	KM4KMU	8,308
Rocky Mountain	WA0KXO	152
Southeastern	WG4I	682
Southwestern	KG6IYN	11,060
West Gulf	KG5UNK	68
Canada	VA2DG	51

Limited Multioperator

Atlantic	W3SO	27,234
Central	WD9EXD	20,350
Great Lakes	W8RU	1,430
Hudson	N2NT	114,452
New England	KM1CC	2,988
Northwestern	W7QH	663
Roanoke	N4HB	25,203
Southeastern	AD4ES	7,668
Southwestern	WO1S	780
West Gulf	K5QE	94,941
Canada	VE3MIS	21,840

Unlimited Multioperator

Atlantic	N3NGE	269,560
Great Lakes	N8GA	35,742
New England	KE1LI	36,935
Southeastern	W4NH	33,912
Southwestern	W7MRF	7,458
West Gulf	KC5MVZ	120

Affiliated Club Competition

Club	Score	Entries
Unlimited		
Mt. Airy VHF Radio Club	1,287,631	69
Medium		
Southern California Contest Club	387,843	18
The Ontario VHF Assn.	387,576	38
North East Weak Signal Group	216,287	17
Arizona Outlaws Contest Club	191,367	28
Potomac Valley Radio Club	124,150	27
Northern California Contest Club	123,283	11
Roadrunners Microwave Group	121,999	9
Pacific Northwest VHF Society	70,138	33
Yankee Clipper Contest Club	52,943	14
Society of Midwest Contesters	37,605	17
Florida Contest Group	20,196	10
Frankford Radio Club	17,258	9
Florida Weak Signal Society	16,584	7
South Jersey Radio Assn.	11,404	11
Northern Lights Radio Society	10,259	14
Central Texas DX and Contest Club	9,890	4
Badger Contesters	8,823	10
DFW Contest Group	7,182	3
Tennessee Contest Group	6,469	5
North Coast Contesters	5,625	3
Granite State ARA	4,864	6
Six Meter Club of Chicago	4,384	6
Grand Mesa Contesters of Colorado	4,272	4
Alabama Contest Group	3,431	4
Michigan VHF-UHF Society	3,121	3
New Mexico VHF Society	2,844	5
Hudson Valley Contesters and DXers	2,063	5
Rochester VHF Group	1,281	4
Willamette Valley DX Club	1,024	3
Alaska VHF-Up Group	706	3
Burlington County Radio Club	506	3
Swamp Fox Contest Group	290	3
Carolina DX Assn.	258	4
Local		
Orleans County ARC	110,684	8
Eastern Connecticut ARA	40,760	6
Gloucester Co. ARC	26,351	5
Chippewa Valley VHF Contesters	13,234	3
Meriden ARC	4,160	3
Bergen ARA	3,912	3
Bristol (TN) ARC	2,748	3
Niagara Frontier Radiosport	688	4

Full Results Online

You can read the full results of the contest online at **http://contests.arrl.org** or **www.arrl.org/contest-results-articles**. You'll find detailed analysis and more play-by-play, along with the full line scores. Improve your results by studying your log-checking report, too.

The 2021 ARRL January VHF Contest will be held January 16 – 18, 2021.

Regional Leaders

LM = Limited Multioperator; R = Classic Rover; RL = Limited Rover; RU = Unlimited Rover; SO3B = Single Operator, Three-Band; SOFM = Single Operator, FM Only; SOHP = Single Operator, High Power; SOLP = Single Operator, Low Power; SOP = Single Operator, Portable, and UM = Unlimited Multioperator.

West Coast Region
(Pacific, Northwestern, and Southwestern Divisions; Alberta, British Columbia, and NT Sections)

N6NB/R	290,640	R
WA6IPZ/R	111,744	R
NI6G/R	110,664	R
W6IT/R	36,960	R
KJ7JC/R	23,125	R
N6GP/R	4,181	RL
K6LMN/R	3,591	RL
WB6HUM/R	1,520	RL
KL7VHF/R	480	RL
KM6ZJK/R	196	RL
K6MI/R	149,684	RU
N6ZE/R	10,848	RU
VE7AFZ/R	1,037	RU
N1AV	67,373	SOHP
WA7XX	32,634	SOHP
W2ODH	13,260	SOHP
K7YDL	10,478	SOHP
KE7SW	8,960	SOHP
W6TV (W6YEP, op)	73,710	SOLP
N7VD	21,840	SOLP
N6HC	14,875	SOLP
WZ8T	8,091	SOLP
K2GMY	5,983	SOLP
K7ATN	6,358	SOP
WA7JTM	5,375	SOP
W7JET	4,378	SOP
K7TAB	3,520	SOP
AA4Q	2,261	SOP
N7EPD	5,600	SO3B
N7IR	3,480	SO3B
N7QOZ	2,376	SO3B
W7OTL	2,256	SO3B
W8JH	1,456	SO3B
KG6IYN	11,060	SOFM
KI7LTT	510	SOFM
W6IA	460	SOFM
K3RW	395	SOFM
KJ7AXA	376	SOFM
WO1S	780	LM
W7QH	663	LM
W7MRF	7,458	UM

Midwest Region
(Dakota, Midwest, Rocky Mountain, and West Gulf Divisions; Manitoba and Saskatchewan Sections)

K2EZ/R	110,715	R
KD5IKG/R	19,431	R
N6RH/R	15,180	R
W5DMB/R	11,475	R
KC0P/R	624	R
KA5D/R	28,480	RL
KI5FIQ/R	15,090	RL
KT5TE/R	14,130	RL
K5ND/R	6,750	RL
KE0MHJ/R	5,074	RL
K5SRT/R	126,816	RU
N0LD/R	111,060	RU
KB0YHT/R	12,236	RU
K5LLL	26,487	SOHP
K5AND	19,028	SOHP
K0TPP	12,054	SOHP
K5TR (W5TN, op)	9,792	SOHP
N5RZ	8,160	SOHP
K5TRA	14,964	SOLP
N0LL	4,368	SOLP
W0ZQ	4,212	SOLP
WB0NRV	3,168	SOLP
N5CXX (WA8ZBT, op)	1,978	SOLP
K0NR	77	SOP
KM4PEH	68	SOP
N0JK	28	SOP
K0JJW	24	SOP
KI5YG	1,720	SO3B
AC5D	546	SO3B
K0VG	528	SO3B
N0UR	486	SO3B
KC7QY	288	SO3B
K0PHP	297	SOFM
N0HDR	205	SOFM
WA0KXO	152	SOFM
KG5UNK	68	SOFM
N0EMU	16	SOFM
K5QE	94,941	LM
KC5MVZ	120	UM

Central Region
(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South, and Greater Toronto Area Sections)

VE3OIL/R	25,608	R
VA3ELE/R	16,785	R
KA9WBT/R	3,243	R
VE3TFU/R	1,170	R
W9YOY/R	2,583	RL
K9JK/R	2,260	RL
VE3RKS/R	1,136	RL
N9GH/R	465	RL
VE3CRU/R	288	RL
VE3ZV	47,058	SOHP
N9AKR	12,936	SOHP
K8ZR	9,765	SOHP
KT9L	7,440	SOHP
W9FF	4,895	SOHP
VE3DS	30,876	SOLP
N8LRG	12,483	SOLP
K9MU	12,410	SOLP
KF8QL	2,775	SOLP
KM8V	2,400	SOLP
K9AA (KO9A, op)	1,080	SOP
KO9A	14,628	SO3B
VE3SST	5,292	SO3B
WA8TTM	2,886	SO3B
VA3MW	2,001	SO3B
W9ZB	1,584	SO3B
WB9WOZ	996	SOFM
K9JK	24	SOFM
N8PPF	12	SOFM
VE3MIS	21,840	LM
WD9EXD	20,350	LM
W8RU	1,430	LM
N9SD	1,104	LM
WB9TFH	612	LM
N8GA	35,742	UM

Southeast Region
(Delta, Roanoke, and Southeastern Divisions)

AG4V/R	27,740	R
W5VY/R	8,100	R
K4RSV/R	1,248	R
W8BRY/R	190	R
AE5P/R	14,550	RL
W5TV/R	6,280	RL
WB8LYJ/R	4,255	RL
KM4OZH/R	3,509	RL
WB5RMG/R	648	RL
K4SME/R	6,486	RU
WD5DJW/R	72	RU
N4QWZ	41,985	SOHP
W3IP	22,896	SOHP
N3MK	19,188	SOHP
WA4GPMa	13,320	SOHP
N4JQQ	11,460	SOHP
W4RAA	7,093	SOLP
KT1R	3,597	SOLP
KO4MA	2,574	SOLP
WA3RGQ	2,345	SOLP
N3CMH	2,294	SOLP
NV4B	195	SOP
N4HUF	4,968	SO3B
AG4W	2,015	SO3B
WA4LDU	1,836	SO3B
W4TM	1,650	SO3B
K4EA	864	SO3B
KM4KMU	8,308	SOFM
WG4I	682	SOFM
K4NRT	15	SOFM
N6DJS	8	SOFM
K3TW	6	SOFM
N4HB	25,203	LM
AD4ES	7,668	LM
WB4WXE	2,880	LM
KN4BBD	350	LM
W4NH	33,912	UM

Northeast Region
(New England, Hudson, and Atlantic Divisions; Maritime and Quebec Sections)

KF2MR/R	69,936	R
K2ET/R	25,608	R
W3ICC/R	22,128	R
NN3Q/R	13,940	R
KV2X/R	13,736	R
WB2SIH/R	7,654	RL
N5BNO/R	4,920	RL
VO2AC/R	2,660	RL
VO2AAA/R	2,660	RL
AF1R/R	1,350	RL
N2SLN/R	2,108	RU
K1TEO	254,196	SOHP
N2YB	81,962	SOHP
K1RZ	81,400	SOHP
WZ1V	49,220	SOHP
WA3DRC	45,066	SOHP
N2WK	66,445	SOLP
AF1T	58,740	SOLP
WA3NUF	56,376	SOLP
WA3GFZ	27,216	SOLP
KR1ST	26,220	SOLP
N2YTF	782	SOP
WB2AMU	418	SOP
KD2TDL	28	SOP
KB3SIG	16	SOP
K3EGE	8	SOP
WA3WUL	8	SOP
W1QK	8,960	SO3B
K1HC	6,384	SO3B
AI3Z	4,935	SO3B
W3FAY	2,673	SO3B
W1DYJ	2,625	SO3B
K2NUD	1,120	SOFM
KD2TFW	240	SOFM
KB1POP	115	SOFM
W2BSN	85	SOFM
VA2DG	51	SOFM
N2NT	114,452	LM
W3SO	27,234	LM
W2MMD	25,772	LM
N2JQR	6,786	LM
WA3EKL	6,660	LM
N3NGE	269,560	UM
KD2LGX	39,744	UM
KE1LI	36,935	UM
W0RSJ	25,920	UM
WA3EHD	24,487	UM

Top Ten

Classic Rover

N6NB/R	290,640
WA6IPZ/R	111,744
K2EZ/R	110,715
NI6G/R	110,664
KF2MR/R	69,936
W6IT/R	36,960
AG4V/R	27,740
VE3OIL/R	25,608
K2ET/R	25,608
KJ7JC/R	23,125

Limited Rover

KA5D/R	28,480
KI5FIQ/R	15,090
AE5P/R	14,550
KT5TE/R	14,130
WB2SIH/R	7,654
K5ND/R	6,750
W5TV/R	6,280
KE0MHJ/R	5,074
N5BNO/R	4,920
WB8LYJ/R	4,255

Unlimited Rover

K6MI/R	149,684
K5SRT/R	126,816
N0LD/R	111,060
KB0YHT/R	12,236
N6ZE/R	10,848
K4SME/R	6,486
N2SLN/R	2,108
VE7AFZ/R	1,037
WD5DJW/R	72

Single Operator, High Power

K1TEO	254,196
N2YB	81,962
K1RZ	81,400
N1AV	67,373
WZ1V	49,220
VE3ZV	47,058
WA3DRC	45,066
N4QWZ	41,985
WB2RVX	40,383
K1KG	37,497

Single Operator, Low Power

W6TV (W6YEP, op)	73,710
N2WK	66,445
AF1T	58,740
WA3NUF	56,376
VE3DS	30,876
WA3GFZ	27,216
KR1ST	26,220
N8RA	21,910
N7VD	21,840
N2OA	15,050

Single Operator, Portable

K7ATN	6,358
WA7JTM	5,375
W7JET	4,378
K7TAB	3,520
AA4Q	2,261
AA6XA	1,160
K9AA (KO9A, op)	1,080
N2YTF	782
WB2AMU	418
NV4B	195

Single Operator, Three-Band

KO9A	14,628
W1QK	8,960
K1HC	6,384
N7EPD	5,600
VE3SST	5,292
N4HUF	4,968
AI3Z	4,935
N7IR	3,480
WA8TTM	2,886
XE2CQ	2,886

Single Operator, FM Only

KG6IYN	11,060
KM4KMU	8,308
K2NUD	1,120
WB9WOZ	996
WG4I	682
KI7LTT	510
W6IA	460
K3RW	395
KJ7AXA	376
K0PHP	297

Limited Multioperator

N2NT	114,452
K5QE	94,941
W3SO	27,234
W2MMD	25,772
N4HB	25,203
VE3MIS	21,840
WD9EXD	20,350
AD4ES	7,668
N2JQR	6,786
WA3EKL	6,660

Unlimited Multioperator

N3NGE	269,560
KD2LGX	39,744
KE1LI	36,935
N8GA	35,742
W4NH	33,912
W0RSJ	25,920
WA3EHD	24,487
W1XM	14,472
W7MRF	7,458
W3RFC	4,428

The 2020 222 MHz and Up Distance Contest

1800 UTC Saturday, August 1 – 1800 UTC Sunday, August 2

The objective of this distance scoring event is to make as many contacts as possible on 222 MHz up to 241 GHz using terrestrial means (no EME contacts) over as great a distance as possible. Participants will exchange six-digit grid locators and distances will be based on the center-to-center distance between each two stations' six-digit locators. Visit **k7fry.com/grid** for a grid mapping/distance tool, courtesy of Steve Fry, K7FRY.

The three station categories are Single Operator, Fixed; Multi-operator, Fixed; and Rover. A station in a specific grid locator may be contacted from the same location only once on each band, regardless of mode. Competition is by region. There is also a Club Competition and a Team Competition. Be sure to register your team at **http://contests.arrl.org** before the start of the contest.

Each band has a unique band factor value. Total score is the sum of QSO points of all contacts.

Only electronic, Cabrillo-formatted logs will be accepted. Upload logs to **http://contest-log-submission.arrl.org**. The deadline for submission of entries is 1800 UTC August 16, 2020.

For event rules, see
www.arrl.org/222-mhz-and-up-distance-contest

Mel Larson, KCØP/R, had his Rover station antennas positioned to work the Twin Cities in Minnesota during the 2019 ARRL 222 MHz and Up Distance Contest. [Mel Larson, KCØP, photo]

August 2020 ARRL Rookie Roundup — RTTY

1800 UTC – 2359 UTC, Sunday, August 16

Rookies make as many contacts as possible during this 6-hour event. Rookies work everyone and non-Rookies work only Rookies.

Licensed only a few months, Clara Orvin, KI5HTX, operated in the 2020 Rookie Roundup (SSB) along with two other Rookies as part of a Multioperator effort at the Razorback Contest Club station, W5YO. [Don Banta, K5DB, photo]

Stations exchange each other's call signs, names, a two-digit year, and state (US or Mexican), Canadian province, or DX.

You can enter as a Rookie if:

- You made or will make your first-ever contact this year or during the previous three calendar years (send the last two digits of the year of your first contact in your exchange); or
- You haven't made any contest contacts using the contest mode (RTTY) before (send the last two digits of the current year in your exchange).

If you are a non-Rookie, send the last two digits of the year you were first licensed.

Rookies can enter as a Single Operator or invite Rookie friends over and operate as Multioperator. Up to five Single Operator Rookies can also enter from their individual stations and submit their total score as a team.

All scores must be reported within 72 hours after the event. No late entries will be accepted.

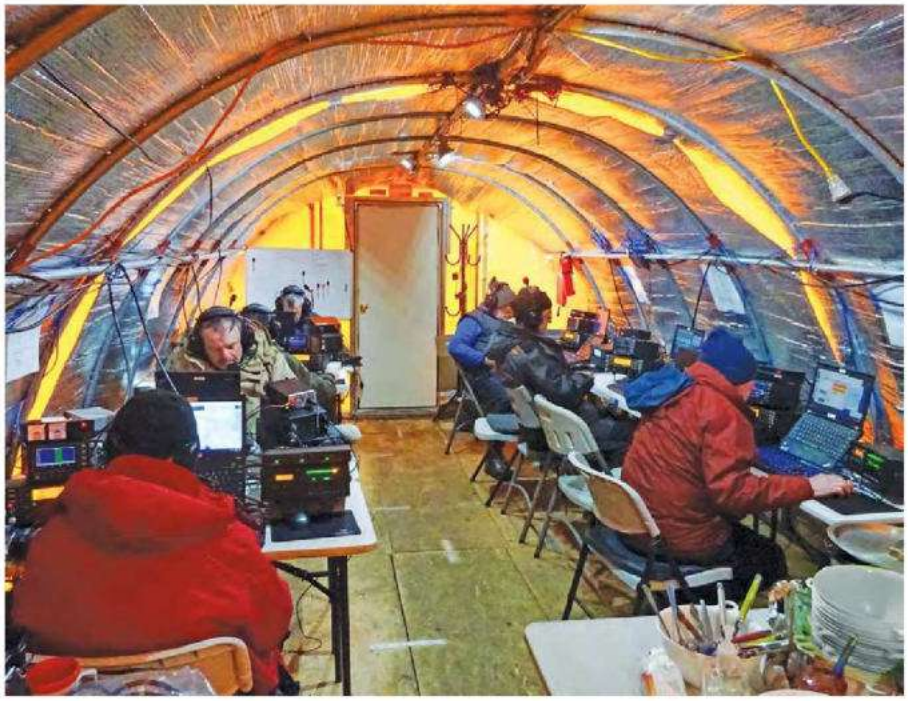
Complete rules, logging sheets, and links for submitting your score can be found at **www.arrl.org/rookie-roundup**

Gene Spinelli, K5GS, k5gs@arrl.net

How's DX?

VP8PJ South Orkney Islands 2020 Recap

During the week of February 10, 2020, DXers from six countries met in Punta Arenas, Chile, to participate in the Perseverance DX Group's next project. After a year of intense planning, we were ready for our journey to the South Orkney Islands, Antarctica, and more specifically, Signy Island. The RV *Braveheart*, a veteran of many DXpeditions, arrived on February 14, and the next day loaded several thousand pounds of equipment, filled the fuel tanks, and took on provisions.



All of the VP8PJ South Orkney Islands stations in operation. [Kenneth Karr, NG2H, photo]

Off to Signy Island

On February 15, the RV *Braveheart* departed Chile for Signy Island, located just within the Antarctic Treaty System at 60° South. We arrived sooner than the anticipated 6-day journey. Upon arrival, we saw significant pack ice along the same shoreline where we'd planned to disembark at Waterpipe Beach, Antarctica.

The pack ice extended about 100 meters from shore, making it too dangerous to off-load equipment. Due to an expected change in wind direction, we hoped the ice would break up and move out by the next morning.

Going Ashore

By the next morning, enough ice moved out for us to transfer people and equipment to the island.

We identified two landing areas: one for equipment and one for people. One landing area was unsuitable for equipment transfers because it required a ladder to reach the campsite path. The crew constructed a temporary ladder that was removed at the end of the project.

Camp Set-Up

The first order of business was to construct the two WeatherPort Shelter System buildings that would be our home for the next 2 weeks. The temperature hovered around freezing most of the time, and the wind and precipitation made it feel colder.

We had designed and prefabricated flooring for the buildings from plywood and steel studs to allow one person to carry a flooring piece in windy conditions. The next priority was a generator shed constructed from rocks and plywood.

Parallel teams installed antennas, furnished the radio building, and unpacked and installed the radio equipment. The other building would be our sleeping quarters. It contained 14 bunks and storage shelves. The interior layout for both buildings was designed before we left home. The campsite location was the same one used by the 2011 VP8ORK DXpedition.

Antenna Plan

Because we were at the bottom of the sunspot cycle, we designed an antenna plan to give us maximum performance. The island is well-positioned for propagation to Europe (EU) and North America (NA), however, our camp had hills immediately to the north and east, making the

David Lloyd, K3EL, (left) and Gene Spinelli, K5GS, (right) climbing the VP8PJ stairway to the campsite. [Arliss Thompson, W7XU, photo]

take-off for North America less favorable than that to Europe, which is straight over water. Asia (AS) and much of Oceania (OC) are challenging from South Orkney with a path over the South Pole. Both South America (SA) and Africa (AF) are relatively close, with excellent propagation much of the time.

The low-band antennas were verticals and four squares, and Moxon Yagis for the HF bands. The combination of horizontal and vertically polarized antennas and Elecraft radios proved to be effective in elimination of interstation interference.

Equipment

We were well-supported by amateur radio manufacturers and distributors: Elecraft loaned eight K3S transceivers, KPA500 amplifiers, P3 panadapters, KAT500 tuners, and the new KPA1500 amplifier. DX Engineering donated coax, connectors, tools, and antenna parts and accessories. WiMo (Europe) donated two tri-band and two WARC-band Moxon antennas. Spiderbeam discounted telescoping masts, and Low Band Systems discounted the high-power band-pass filters. Arlan Communications loaned (and later discounted) RadioSport headsets. Inmarsat Government donated communications equipment and satellite services. The DX Store and ON5UR QSL Print Service helped offset the cost of QSL cards. Mastrant and Clamcleat each donated guying ropes and fittings. The generosity of these manufacturers and distributors was greatly appreciated.

Team members provided SPE linear and OM Power amplifiers. Our logging computers were Lenovo X230 laptops. Many of the Pelican and other shipping cases were loaned by Paul Ewing, N6PSE, (Intrepid DX Group) and Jim Sansoterra, K8JRK, while others came from the team.

Radio Operations

The first contact was made on 40-meter CW with DL2HRF on February 22, and the final one was a 30-meter CW contact with WA6RRI on March 6. A few minutes after the first contact was logged, two additional stations came online. The next morning, the team continued antenna and campsite buildout, and by the end of that day most stations were operational. We were delighted to find good propagation and reasonably strong signals to many parts of the world, with Europe being the best. Later into the expedition, conditions dropped off a little, but overall we had few complaints about propagation.

During periods of good propagation, all seven operating positions were staffed. As propagation faded during the night, single sideband (SSB) dropped out first. The SSB operators would switch to FT8, where a single operator could handle multiple FT8 stations simultaneously.

DXpedition Stats

We made 83,782 contacts with 20,523 unique call signs: Europe (EU) 52.7%, North America (NA) 34.8%, Asia (AS) 6.4%, South America (SA) 4.5%, and Africa (AF)/Oceania (OC) 1.6%, with 168 DXCC entities. We logged 40,143 CW contacts, 27,152 FT8 contacts, 14,047 SSB contacts, and 2,440 RTTY contacts, giving out many all-time new ones (ATNOs).

Thanks to our Sponsors and Friends

We appreciate the support from DX clubs, foundations, and individual donors. Our major financial sponsors were the Northern California DX Foundation (NCDXF), the German DX Foundation (GDXF), ARRL's Colvin Award, the Clipperton DX Club, and the Far East DX-Exploiters.

We can't say enough about Captain Matt Jolly and the RV *Braveheart* crew, who were instrumental to the project's success. Our pilot team and off-island support personnel kept us informed throughout the DXpedition.

We appreciated the cooperation we received from the US Department of State's Office of Ocean and Polar Affairs, the National Science Foundation (NSF), and the Environmental Protection Agency.

All confirmation requests go to our QSL Manager Tim Beaumont, MØURX, at **www.m0urx.com**.

Thank you for making VP8PJ a success. For more information on this DXpedition, visit **www.sorkney.com**.

Jon Jones, NØJK, n0jk@arrl.org

The World Above 50 MHz

Remarkable April Opening

In the midst of the COVID-19 pandemic, the 6-meter April 15, 2020 opening was a welcome one.

Ken, WB2AMU, noted that multi-hop sporadic-E openings are rare in April, and this one was even more remarkable because of the solar flux of 69. He added that he could still hear several stations on 50.094 MHz even an hour after he'd made a contact with them. Clearly, we all needed this.

Extensive TEP

With many people home due to "stay at home" orders, the band was full. Six meters opened in the morning, and it didn't close until late evening. Around 1900Z, stations in Central America and Ecuador began working into the northeast and midwest states. Scott, KF2ZQ (FN30), logged TG9ANF. KFØM (EM17) said he worked into Ecuador around 1900Z. Around 2100Z, the band exploded with wall-to-wall E_s across the lower 48 states into Central and northern South America. The extensive sporadic E set up links to trans-equatorial propagation deep into Chile and Argentina. I noted east coast stations, like N2GHR, spotted LU9DO and others by 2105Z.

I was ready on portable with a two-element Yagi on a 10-foot mast by 2140Z (see Figure 1). On FT8, every sequence was full of stateside stations, along with XE and Central American stations, such as TG9ANF. A few minutes later decodes popped up from LU8YD.

I worked XE1/N4DMH (EK08) on FT8 at 2223Z, followed by CE6UFF at 2226Z. I logged Bob, V31AE (FK58), at 2239Z. Robert says he uses a three-element Yagi on the roof of his home and 100 W. He lives in the northern part of Belize.

Bruce, KØBJ (DM99), in Colby, Kansas, said:

> I worked stations in Chile, Argentina, Ecuador, and Panama for new DXCC band countries. PY8 in northern Brazil was my previous farthest in South America. I picked up multiple grids in LU and HC, as well as a few new ones in Mexico, and a couple in the southern US.

He runs 100 W and an 11-element log periodic array at 60 feet.

From Smith Center, Kansas, Larry, NØLL (EM09), worked HC2DR, HC2FJ (FI08), V31AE, TG9AJR, XE2MLR (DL74), and HP2DFA. He was running 150 W to a five-element Yagi.

A 6-meter EME expert, Lance, W7GJ, reported, "April 15 was the best 6-meter activity I have ever seen this early in the season." He explained that an opening from western Montana lasted 9 hours. "We are normally one or two hops away from linking into any high TEC activity or TEP propagation. Usually, it seems a higher Kp index is required to cause 6-meter sporadic-E openings to the south from up here." He added that the reason for the success could be the time of year, along with the fact that the Kp index had been up to 3 on both April 14 and early on April 15.

Figure 1 — My portable 6-meter setup during the opening on April 15, 2020. [Jon Jones, NØJK, photo]

High-Activity Challenges

There were so many stations trying to get in on the opening, making it difficult to complete contacts. I heard many other stations from South America, including three HC stations, but I was unable to work any despite many calls. I suspect the DX stations were being crushed with callers. With so many stations active in the 2.5 kHz FT8 passband, weaker stations were pushed into the noise floor.

John, KFØM, commented:

> We are trying to cram the number of stations that in history would have been spread across 150 kHz down to about 2 kHz, and the receiver can't handle it. I don't think turning off the AGC is the answer because strong stations will still overload the RF portion of the RX, and manually turning down the RF gain to stop the overload will have the same effect as the AGC.

A possible solution is to use 50.323 MHz as a DX window for 6-meter FT8, or spread out to 50.314.5 and higher. But when using CAT control, it's not easy to tune the radio around to look for signals. So, everyone ends up on 50.313 MHz.

KFØM suggested that a short-term fix may be to have the DX stations transmit on low audio, and listen up, but this tactic on a busy opening like the one on April 15 may have caused more interference than help.

On the Bands

50 MHz. Sporadic E continued into April. On April 1, N1AV (DM43) worked K9MK (EM12) with "+20 dB signals." Lance, W7GJ, made the first 6-meter contact between North America and Tajikistan with EY8MM on April 3 at 2148Z using JT65. On April 5, Mario, K2ZD, logged EY8MM on EME. The best signal strength was –27 dB. Matt, K6EME (DM06), also worked Nodir, EY8MM, on April 8. This was an EMA contact from a single Yagi to a single Yagi (see Figures 2 and 3).

On April 9, LU9FF and LU9FVS spotted K4CVL on 50.313 MHz FT8 at 2230Z. K4TR and NN4X in south Florida spotted stations in Chile. Signals were strong enough for SSB, with AC4TO (EM70) working CA3SOC and LU8YD on 50.110 MHz at 2224Z. KN4NN (EM70), AA5AU, and NØFW (EM79) in Ohio also made FT8 contacts with South America. These were contacts made by sporadic E linking to afternoon trans-equatorial propagation across the geomagnetic equator. The next day, Larry, NØLL (EM09), decoded LU1YT at 2144Z and LU8YD at 2143Z.

On April 11, W4LES (EM84) in South Carolina spotted ZL1RQ at 0020Z. KFØM (EM17) logged XE3WM (EL51) and heard CM2RSV (EL83) at 0026Z. KQØJ (EL87) logged TG9ANF (EK44) and several XE1 stations. Activity picked up on April 14, with widespread E_s across the Gulf of Mexico. KQØJ (EL87) worked Cuba, Belize, Guatemala, and rare Guantanamo Bay. Danny, KB8W (EN57), worked CM2XN (EL83) and the southeast states. WA2GFN worked as far west as Colorado.

I copied ZF1EJ (EK99) for almost an hour on FT8. On April 16, Sam, K5SW (EM25), logged HK6F (FK24) on SSB at 2344Z. On April 27, Paul, WBØBBC, in Florida, worked KP4DGW on FT8.

Figure 2 — Matt Kennedy's, K6EME, moonbounce antenna. [Matt Kennedy, K6EME, photo]

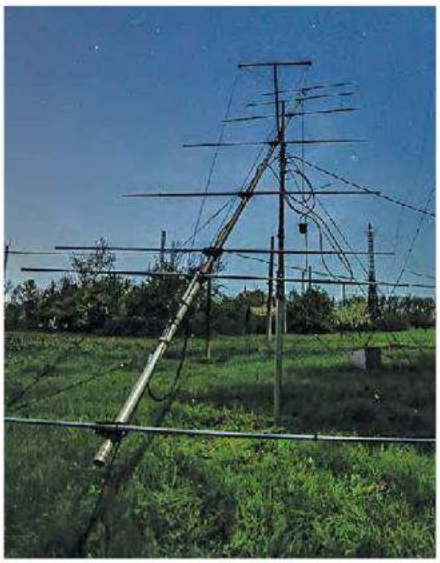


Figure 3 — Nodir Tursun-Zade's, EY8MM, EME Yagi. [Nodir Tursun-Zade, EY8MM, photo]

144 MHz. Mike, K7ULS, in Utah, logged K1DG in New Hampshire via EME on April 6. On April 7, John, KFØM (EM17), worked a number of stations in Texas on tropospheric propagation, including vertically polarized W5ICK (EM12). There was over 20 dB loss between vertical polarization (used for FM on 2 meters) and horizontal polarization, which is the standard for SSB, CW, and digital modes.

Two-meter sporadic E made a rare April appearance during the big April 15 opening. Jim, KO9A (EN52), worked KO4MA (EL88) at 1905Z using FT8. Jim uses an Icom IC-9700 at 100 W to a five-element Yagi up 25 feet. On April 22, during the Lyrid meteor shower, Gary, N2AMC (FN30), worked AK4R (EM65) on MSK144. He said the contact took only 45 seconds. NØLL was portable in EN00 and made about a dozen contacts. WZ1V (FN31) reported four MSK144 contacts. His best DX contact was with KF4FCO (EM70).

432 MHz. KFØM (EM17) worked K5FAL (EM15), who used vertical polarization.

Feedback

Since the nanoVNA Product Review was published in the May 2020 issue of *QST*, I have learned that macOS and Linux versions of the *nanoVNA Saver* software may be downloaded from **github.com/mihtjel/nanovna-saver**. The nanoVNA Users group (**groups.io/g/nanovna-users**) continues to offer the Windows version, as noted in the review. — *Phil Salas, AD5X*

Maty Weinberg, KB1EIB, events@arrl.org; www.arrl.org/special-event-stations

Special Event Stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

Because of the COVID-19 pandemic, many organizations are canceling or rescheduling events. This is the information we had at the time we went to press. We suggest you contact the event organizer to confirm. — *Ed.*

Through Dec. 31, 0000Z – 2359Z, W5YD, Mississippi State, MS. W5YD Mississippi State University Amateur Radio Club. **W5YD Centennial Celebration**. 80, 40, 20, and 17 meters. QSL. Mississippi State University Amateur Radio Club, Dept. of Physics & Astronomy, P.O. Box 5167, Mississippi State, MS 39762-5167. **www.w5yd.org.msstate.edu**

Through Dec. 31, 0000Z – 2359Z, various, various cities, IA. Great River Amateur Radio Club. **Iowa State Parks On-the-Air Centennial Celebration**. All bands, all frequencies, as available. Certificate & QSL. IASPOTA-2020, c/o Great River Amateur Radio Club, P.O. Box 1384, Dubuque, IA 52004. *Members will operate with their own call signs from state parks throughout Iowa. Operating as time permits, mostly weekends. QSL for contact; certificate for five parks. See website for details.* **www.w0dbq.org/iaspota**

June 22 – Aug. 9, 1600Z – 1600Z, K2BSA/3, Rising Sun, MD. Chester County Council BSA Camp Horseshoe Scout Reservation. **BSA Camp Horseshoe Scout Reservation**. 14.325; primarily 20 and 40 meters, camp station is capable of operating from 80 meters and up; modes will be SSB, digital PSK/RTTY, and CW when possible. QSL. Walt Beattie, 2315 Bradley Way, Pottstown, PA 19464-2684. *QSL cards welcomed; if possible, please ID operator with whom you spoke.* **https://k2bsa.net/2020/02/camp-horseshoe-2019-summer-camp-k2bsa-3**

June 29 – July 5, 0400Z – 0400Z, W9IMS, Indianapolis, IN. The Indianapolis Motor Speedway Amateur Radio Club. **The Brickyard 400**. 18.140 14.245 7.245 3.840. Certificate & QSL. Indianapolis Motor Speedway Amateur Radio Club, P.O. Box 30954, Indianapolis, IN 46230. **www.w9ims.org**

June 30 – July 1, 1500Z – 0000Z, N7GMH, Prescott, AZ. Yavapai Amateur Radio Club. **Granite Mountain Hotshots Memorial**. 18.119 14.319 7.219 3.819. Certificate. Don Bauer, 7150 E. Acre Way, Prescott Valley, AZ 86315. *Remembering the 19 Granite Mountain Hotshot firefighters lost in Yarnell, AZ, on June 30, 2013.* **www.w7yrc.org**

July 4, 1400Z – 2200Z, W7PX, Missoula, MT. The Hellgate Amateur Radio Club. **W7PX 4th of July**. 14.260 14.074 7.240 7.074. QSL. Hellgate Amateur Radio Club, P.O. Box 3811, Missoula, MT 59806-3811. *Celebrating Independence Day at Historic Fort Missoula.* **www.w7px.org**

July 4, 1400Z – 2000Z, K4RC, Williamsburg, VA. Williamsburg Area Amateur Radio Club. **Colonial Williamsburg Special Event**. 14.265 7.265. QSL. QSL Manager, K4RC, P.O. Box 1470, Williamsburg, VA 23187. *244th anniversary of signing of the Declaration of Independence in 1776.* **www.k4rc.net**

July 11 – July 13, 1700Z – 2359Z, W5D, Adair, OK. Mayes County Amateur Radio Club. **Dalton Gang SES**. 14.240 7.225 3.850. QSL. MCARC, P.O. Box 1195, Spavinaw, OK 74366. **MCARC@qsl.net**; **www.qrz.com/db/w5d** *or* **www.mcarc.me**

July 11, 1300Z – 1900Z, N3V, Lanham, MD. American Legion Post 275. **Peace Cross Celebration**. 7.275; 145.43 PL114.8. Certificate & QSL. The American Legion Post 275 TALARC, 8201 Martin Luther King Jr. Hwy, Lanham, MD 20706. **wa3dvo@gmail.com** *or* **www.qrz.com/db/n3v**

July 12, 1500Z – 1900Z, WØOEL, Fayette, IA. Rural Iowa Amateur Radio Club. **Iowa State Parks On-the-Air Centennial — Volga River**. 14.240 7.240. Certificate & QSL. Great River Amateur Radio Club, P.O. Box 1384, Dubuque, IA 52004. *QSL for contact; certificate for five parks. See website for information.* **www.w0dbq.org/rules** *or* **www.w0oel.com**

July 18, 1300Z – 2200Z, WØKY, Kearney, NE. Midway Amateur Radio Club. **Kearney Junction Park**. 21.345 21.045 14.290 14.045. Certificate. Henry Angle, NØHA, 307 E. 35th St., Kearney, NE 68847.

July 18 – July 26, 0000Z – 2359Z, W5I, Sherman, TX. Grayson County Amateur Radio Club. **Red River Bridge War Special Event**. 14.250 14.040 7.250 7.040. QSL. Grayson County ARC, P.O. Box 642, Sherman, TX 75091. **www.qrz.com/db/w5i** *or* **https://graysoncountyarc.org**

July 25, 1300Z – 1900Z, W4OT, Vero Beach, FL. Vero Beach Amateur Radio Club. **In Remembrance of the 305th Anniversary of the Spanish 1715 Treasure Fleet (lost in a hurricane on their way to Spain)**. 14.327; D-STAR Ref078C. Certificate. Vero Beach Amateur Radio Club c/o IRC EOC, 4225 43rd Ave., Vero Beach, FL 32967. **w4ot.webs.com**

July 25 – July 31, 1800Z – 1800Z, K8V, Elkins, WV. National Speleological Society. **NSS 79th Annual Convention**. 14.285 14.050 7.195. QSL. Sam Rowe, 2749 Commercial Ave., Madison, WI 53704-4868. *CW, slow speed, Saturday only.* **www.nss2020.caves.org**

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12-inch self-addressed, stamped envelope (three units of postage) to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**.

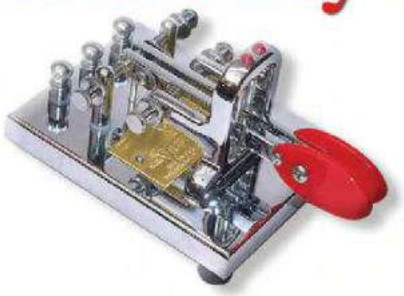
Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **October** *QST* would have to be received by **August 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Events page. Note: All received events are acknowledged. If you do not receive an acknowledgement within a few days, please contact us. ARRL reserves the right to exclude events of a commercial or political nature.

You can view all received Special Events at **www.arrl.org/special-event-stations**.

Certificate of Code Proficiency

Recipients

Sponsored by VIBROPLEX
www.vibroplex.com



This month, ARRL and Vibroplex recognize merit and progress in Morse code proficiency on the part of the following individuals, who have achieved proficiency at the following rates, in words per minute.

February 2020

Scott B. Hedberg, N0ZB	10
Thomas F. Miller, W1PDI	10
James A. Poulette, WQ2H	10
Mark D. Thorn, KN4HYV	10
Kristopher P. Davis, N5KPD	15
John M. Dziedziejko, W9QP	15
Robert W. Jorgenson, N4OUD	15
Gerald Lemay, VA2GLU	15
Stacey D. Sonneland, KG5KGU	15
Frank P. Arciuolo, W1ZAH	25
Timothy M. Cherrone, WK9P	25
Thomas M. Dickhudt, W0LGU	25
Michael P. Malone, N5WNG	25
Kurt T. Meyers, W8IQ	30
Thadeus H. Niemira, K6TET	40

March 2020

Paul A. Gierow, KN4NVU	10
Richard J. Guerrera, KB1FGC	10
Justin C. Jackson, Jr., WB4ABY	10
Wieslaw Kokoszka, KD8UDU	10
Michael S. Lundy, W4MSL	10
William D. Paul, Sr., KK4LYQ	10
Reiner R. Dieg, N2PEZ	15
Richard J. Guerrera, KB1FGC	15
Thomas F. Miller, W1PDI	15
Randall W. Woessner, KC1NN	15
Robert B. Brown, K6AAQ	20
Cesidio DiBenedetto, Jr., KD8OOB	20
Robert S. Zarges, Jr., K2MZ	20
David R. Otto, KC8ZH	25

April 2020

Daniel L. Allen, Jr., KB4ZVM	10
Teri J. De Leo, K7RBT	10
Robert H. Dickerson, W7VD	10
David R. Hague, K1DRH	10
Michael L. Marquissee, K9QOO	10
Thomas J. Mozdzen, K7MOZ	10
Jerome F. Palmer, N3KRX	10
James N. Wolf, KW4UT	10
Robert L. Crispin, KM7Q	20
William J. Otten, KC9CS	25

Congratulations to all the recipients.

July 2020 W1AW Qualifying Runs

W1AW, the Hiram Percy Maxim Memorial Station at ARRL Headquarters in Newington, Connecticut, transmits Morse code Qualifying Runs to assist ham radio operators in increasing and perfecting their proficiency in Morse code. Amateur radio operators can earn a Certificate of Code Proficiency or endorsements by listening to W1AW Qualifying Runs.

July Qualifying Runs will be transmitted by W1AW in Newington, Connecticut at the times shown at 1.802.5, 3.581.5, 7.047.5, 14.047.5, 18.097.5, 21.067.5, 28.067.5, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by KH6TU on Tuesday, July 28 at 6 PM HST (0400 UTC July 29) on 7047.5 and 14047.5 kHz. Unless indicated otherwise, sending speeds are from 40 to 10 WPM.

Amateur radio operators who participate in Qualifying Runs may submit proof of 1 minute of the highest speed they have copied in the hope of qualifying for the Certificate of Code Proficiency, or an endorsement to their existing certificate.

Legibly copy at least 1 minute of text by hand, and mail the sheet to: W1AW Qualifying Runs, 225 Main St., Newington, CT USA 06111.

Include $10 (check or money order) if this is a submission for your initial Code Proficiency certificate; $7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your test will be checked against the actual transmissions to determine if you have qualified.

For more information about Qualifying Runs, please visit **www.arrl.org/qualifying-run-schedule**.

For information about how to qualify for the Certificate of Code Proficiency, please visit **www.arrl.org/code-proficiency-certificate**.

W1AW Code Proficiency Schedule — July 2020
(All times in Eastern Daylight Time)

Monday	Tuesday	Wednesday	Thursday	Friday
7/6 4 PM – 2000Z 10 – 35 WPM	**7/7** 7 PM – 2300Z 35 – 10 WPM		**7/9** 10 PM – 0200Z **(7/10 – UTC)** 10 – 40 WPM	**7/10** 9 AM – 1300Z 10 – 35 WPM
	7/14 4 PM – 2000Z 10 – 35 WPM	**7/15** 7 PM – 2300Z 10 – 40 WPM	**7/16** 9 AM – 1300Z 35 – 10 WPM	**7/17** 10 PM – 0200Z **(7/18 – UTC)** 10 – 35 WPM
	7/21 9 AM – 1300Z 10 – 35 WPM	**7/22** 10 PM – 0200Z **(7/23 – UTC)** 35 – 10 WPM	**7/23** 7 PM – 2300Z 10 – 35 WPM	**7/24** 4 PM – 2000Z 10 – 40 WPM
7/27 10 PM – 0200Z **(7/28 – UTC)** 10 – 40 WPM		**7/29** 9 AM – 1300Z 35 – 10 WPM	**7/30** 4 PM – 2000Z 35 – 10 WPM	**7/31** 7 PM – 2300Z 10 – 35 WPM

Convention and Hamfest Calendar

Abbreviations

Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Because of the COVID-19 pandemic, many organizations are canceling or rescheduling events. This is the information we had at the time we went to press. We suggest you contact the event organizer to confirm. — *Ed.*

ROCKY MOUNTAIN DIVISION CONVENTION

August 7 – 9, Parker, CO

D H Q R S

7 AM. *Spr:* HamCon Colorado. CU Denver South, 10035 S Peoria St. *Tl:* RMHam "Wide" (DRM) and Colo Connection. HamCon Colorado *Adm:* Advance $40, door $50. **www.hamconcolorado.com**

Florida (Milton) — July 10 – 11 D H R T V

Fri. noon – 7 PM, Sat. 8 AM – 1 PM. *Spr:* Milton ARC. Santa Rosa County Auditorium, 4350 Spikes Way. *Tl:* 145.49 (100 Hz). *Adm:* $6. **www.miltonarc.org**

Illinois (Carlinville) — Aug. 1 D F H Q R S T V

6 AM – 12:30 PM. *Sprs:* Macoupin County ARC, Montgomery County ARC, Okaw Valley ARC, Sangamon Valley ARC. Macoupin County Fairgrounds, 21149 State Rte. 4. *Tl:* 444.25 (103.5 Hz). *Adm:* $5. **www.k9mce.com**

Illinois (Paloma) — Aug. 8 D F H R T V

8 AM – noon. *Spr:* West Illinois ARC. Paloma Shelter House, 1825 E. 1635th St. *Tl:* 147.03 (103.5 Hz). *Adm:* $7. **http://www.w9awe.org/Swapfest.pdf**

Illinois (Peotone) — Aug. 2 D F H R S T V

6 AM – 1 PM. *Spr:* Hamfesters RC. Will County Fairgrounds, 710 S. West St. *Tl:* 146.52, 442.45 (114.8 Hz). *Adm:* Advance $8, door $10. **www.hamfesters.org**

Indiana (Angola) — Aug. 8 F H R T

8 – 11 AM. *Spr:* Land of Lakes ARC, LLC. Gateway Community Church, 225 N. Gerald Lett Ave. *Tl:* 147.18 (131.8 Hz). *Adm:* $5.

Indiana (Auburn) — July 11 D H T

9 AM – 3 PM. *Spr:* Northeastern Indiana ARA. Auburn Cord Duesenberg Museum, 1600 S. Wayne St. *Tl:* 147.015. *Adm:* $5, children under 12 are free. **www.w9ou.org**

IOWA STATE CONVENTION

August 8 – 9, Central City, IA

D F H Q R S T V

Sat. 8 AM – 5 PM, Sun. 8 AM – 3 PM. *Spr:* Cedar Valley ARC. Linn County Fairgrounds, 201 Central City Rd. *Tl:* 146.52 (192.8 Hz). *Adm:* $10. **www.w0gq.org/hamfest**

Kentucky (Lexington) — Aug. 8 D F H Q R S V

7 AM – 3 PM. *Spr:* Bluegrass ARS. Jackpot Bingo, 1230 Eastland Dr. *Tl:* 146.76. *Adm:* Advanced $5, door $6. **www.bluegrassars.org**

Louisiana (Slidell) — July 24 – 25 D F H R S V

Fri. 2 – 5 PM, Sat. 8 AM – 2 PM. *Spr:* Ozone ARC. Slidell Auditorium, 2056 2nd St. *Tl:* 147.27 (114.8 Hz). *Adm:* $5. **www.w5sla.net**

Michigan (Escanaba) — Aug. 1 D F H R S

9 AM – 2 PM. *Spr:* Delta County ARS. Bay de Noc Community College, 2001 N. Lincoln Rd. *Tl:* 147.15 (100 Hz). *Adm:* $5. **www.k8pl.org**

Michigan (Gladwin) — July 25 D F R

10 AM – 3 PM. *Spr:* Gladwin Area ARC. Gladwin City Park Activity Center, 240 City Park St. *Tl:* 147.18 (173.8 Hz). *Adm:* $5.

Michigan (Temperance) — July 11 D F H R

9 AM – 1 PM. *Spr:* Northwest Ohio Black Swamp Radio Society. St. Luke's Lutheran Church, 1690 W. Stearns Rd. *Tl:* 146.42. *Adm:* $5.

Minnesota (Roseville) — July 11 F R T V

8 AM – noon. *Spr:* Galilee Lutheran Church, 145 N. McCarrons Blvd. *Tl:* 145.17. *Adm:* Free. **www.magicrepeater.net/fest.htm**

Missouri (O'Fallon) — Aug. 9 D F H R V

7 AM – 12 PM. *Spr:* St. Charles ARC. Elks Lodge, 1163 Tom Ginnever Ave. *Tl:* 146.67, 145.33. *Adm:* $5 for one ticket, $20 for five tickets. **www.wb0hsi.org/hamfest**

Missouri (Warrensburg) — July 18 D H R S T

8 AM – 1 PM. *Sprs:* WAARCI, Johnson County ARES, Mo-Kan Council. Johnson County Fairground Rural Youth Community Center. *Tl:* 146.88 (107.2 Hz) *Adm:* Free. **www.waarci.org**

MONTANA STATE CONVENTION

July 16 – 19, Essex, MT

D F H Q R S T V

8 AM – 8 PM. *Spr:* GFAARC. Glacier Meadow RV Park, 15735 US Hwy. 2. *Tl:* 146.52. *Adm:* Advance $15, door $20.

New Jersey (Augusta) — July 12 D F H Q R T V

8 AM – 2 PM. *Spr:* Sussex County ARC, Inc. Sussex County Fairgrounds, 37 Plains Rd. *Tl:* 147.3 (151.4 Hz). *Adm:* $8. **www.scarcnj.org/hamfest.html**

New York (Alexander) — July 18 D F H R T V

6 AM. *Spr:* Lancaster ARC. Alexander Fire Department Grounds, 10708 Alexander Rd. (Rte. 98). *Tl:* 147.285 (141.3 Hz). *Adm:* $8. **www.w2so.org**

New York (Deerfield) — July 26 D F H R T V

8 AM – noon. *Spr:* Utica ARC. Deerfield Fire Department Grounds, 5476 Trenton Rd. *Tl:* 146.76. *Adm:* $5. **www.uticaarc.com**

New York (Syracuse) — July 11 D F H R T V

7:30 AM – 12:30 PM. *Spr:* Radio Amateurs of Greater Syracuse. Lakeside Fire Station, 1002 State Fair Blvd. *Tl:* 146.91/31 (103.5 Hz). *Adm:* $5. **www.ragsclub.org**

A = AUCTION
D = DEALERS / VENDORS
F = FLEA MARKET
H = HANDICAP ACCESS
Q = FIELD CHECKING OF QSL CARDS
R = REFRESHMENTS
S = SEMINARS / PRESENTATIONS
T = TAILGATING
V = VE SESSIONS

New York (Trumansburg) — Aug. 1 D F H R T V
7 AM – 2 PM. *Spr:* Tompkins County ARA. Trumansburg Fairgrounds, 2150 Trumansburg-Ithaca Rd. (NYS Rte. 96). *Tl:* 146.97, 146.146, 146.37 (103.5 Hz). *Adm:* $5. **www.tcara-ny.org**

North Carolina (Cary) — July 18 D F H R T V
8 AM – 1 PM. *Spr:* Cary ARC. Ritter Park, 301 W. Lochmere Dr. *Tl:* 146.88 -.6. *Adm:* $4. **www.caryarc.org**

North Carolina (Fayetteville) — Aug. 8 D F H R T V
8 AM – noon. *Spr:* Cape Fear ARS. Cumberland County Shrine Club, 7040 Ramsey St. *Tl:* 146.91 (100 Hz). *Adm:* Free. **www.cfarsnc.org**

North Carolina (Salisbury) — July 11 D F H R T V
8 AM – 2 PM. *Spr:* Rowan ARS. Salisbury Civic Center, 315 Martin Luther King Ave. S. *Tl:* 145.41 (136.5 Hz). *Adm:* Advance $4, door $5. **www.rowanars.com**

North Carolina (Waynesville) — July 25 D F H R S T V
8 AM – 2 PM. *Spr:* Western Carolina ARS. Haywood County Fairgrounds, 758 Crabtree Rd. *Tl:* No talk-in. *Adm:* Advance $5, door $7. **www.wcars.org/wcarshamfest.htm**

Ohio (Ravenna) — July 26 D F H R V
8 AM – 2:30 PM. *Spr:* Portage ARC. Maplewood Career Center, 7075 State Rte 88. *Tl:* 144.79 (145.39 Hz). *Adm:* $5. **www.hamfair.com**

OHIO SECTION CONVENTION
August 8, Tallmadge, OH
D F H Q R S T V
7 AM – 2 PM. *Spr:* DX Engineering. DX Engineering, 1200 Southeast Ave. *Tl:* 146.985. *Adm:* $Free. **www.dxengineering.com**

Ohio (Van Wert) — July 19 D F H R T
8 AM – 1 PM. *Spr:* Van Wert ARC. Van Wert County Fairgrounds, 1055 S. Washington St. *Tl:* 146.25/.85. *Adm:* $5. **www.w8fy.org**

OKLAHOMA STATE CONVENTION
July 24 – 25, Oklahoma City, OK
D F H R S V
Fri. 3 – 10 PM, Sat. 8 AM – 3 PM. *Spr:* Central Oklahoma Radio Amateurs. Oklahoma City Community College, 7777 S. May Ave. *Tl:* 147.21 (141.3 Hz). *Adm:* Advanced $10, door $12. **www.hamholiday.com**

Pennsylvania (Chambersburg) — July 25 D F H Q R S T V
8 AM – noon, license exam at 1 PM. *Spr:* Cumberland Valley ARC. Cumberland Valley Engine and Machinery Association Showgrounds, 1501 Crider's Church Rd. *Tl:* 147.12 (100 Hz). *Adm:* $5. **www.w3ach.org**

Pennsylvania (Kimberton) — July 11 D H R T V
8 AM. *Spr:* Mid-Atlantic ARC. Kimberton Fire Company Fairgrounds, 762 Pike Springs Rd. *Tl:* 145.13, 147.06 (both 131.8 Hz). *Adm:* $7. **www.marc-radio.org**

Pennsylvania (Somerset) — July 19 D F H R T V
8 AM – 1PM. *Spr:* Somerset County ARC. Somerset County Technology Center, 281 Technology Dr. *Tl:* 147.195 (123 Hz). *Adm:* $5. **www.k3smt.org/hamfest/famfest.htm**

Pennsylvania (Uniontown) — Aug. 8 D F H R S T V
8 AM – 2 PM. *Spr:* Uniontown ARC. Uniontown ARC Clubhouse, 433 Old Pittsburgh Rd. *Tl:* 147.045 (131.8 Hz). *Adm:* Free. **www.w3pie.org**

South Dakota (Sioux Falls) — July 18 F H R T
8 AM – noon. *Spr:* Sioux Empire ARC. Marlin's Truck Stop, 47056 271st St. *Tl:* 146.895 (146.2 Hz). *Adm:* Free. **www.w0zwy.org**

Tennessee (Lebanon) — July 25 D F H Q R S T V
8 AM – 3 PM. *Spr:* Wilson County ARC, Inc. James E. Ward Agricultural Center, 945 E. Baddour Pkwy. *Tl:* 147.105 (156.7 Hz). *Adm:* $5. **www.midtnhamquest.com**

Texas (Texas City) — July 11 D F H Q R S T V
9 AM – 1 PM. *Spr:* Tidelands ARS. Doyle Convention Center, 2101 5th Ave. N. *Tl:* 147.14 (167.9 Hz), 442.025 (103.5 Hz). *Adm:* Advance $4, door $5. **www.tidelands.org**

Virginia (Berryville) — Aug. 2 D F H Q R T V
8 AM – 4 PM. *Spr:* Shenandoah Valley ARC. Clarke County Ruritan Fairgrounds, 890 W. Main St. *Tl:* 146.82 (146.2 Hz). *Adm:* $10. **www.svarc.us/hamfest**

Virginia (Salem) — Aug. 1 D F H R V
8 AM – noon. *Spr:* Roanoke Valley ARC. American Legion Post 3, 710 Apperson Dr. *Tl:* 146.985 (107.2 Hz). *Adm:* Free. **www.roanokehamfest.info**

West Virginia (Huntington) — Aug. 8 D F H Q R S V
8:30 AM – 1:30 PM. *Spr:* Tri-State ARA, Inc. New Baptist Church, 610 28th St. *Tl:* 146.76/16. *Adm:* $5, children under 12 are free. **www.qsl.net/w8va**

Wisconsin (Onalaska) — Aug. 8 D H Q R T V
8 AM – 1 PM. *Spr:* Riverland ARC. Onalaska American Legion, 731 Sand Lake Rd. *Tl:* 146.97 (131.8 Hz). *Adm:* $5.

Wisconsin (Racine) — Aug. 8 D F H R T
6 AM – 1 PM. *Spr:* Racine Megacycle Club. Greater Racine Kennel Club, 6320 Six Mile Rd. *Tl:* 147.27 (127.3 Hz). *Adm:* Free. **www.w9udu.org**

To All Event Sponsors

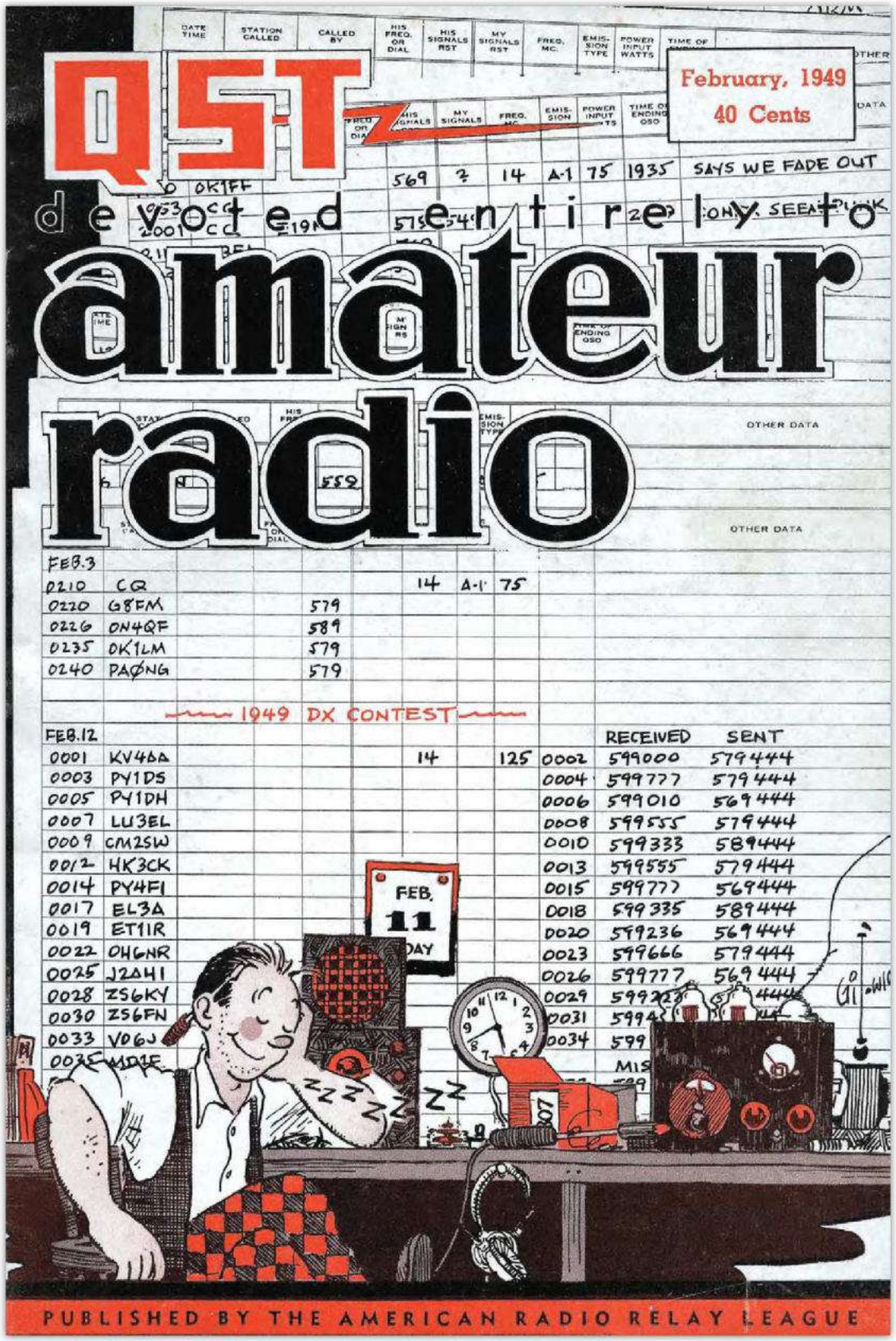
Before making a final decision on a date for your event, you are encouraged to check the Hamfest and Convention Database (**www.arrl.org/hamfests-and-conventions-calendar**) for events that may already be scheduled in your area on that date. You are also encouraged to register your event with HQ as far in advance as your planning permits. See **www.arrl.org/hamfest-convention-application** for an online registration form. Dates may be recorded up to 2 years in advance.

Events that are sanctioned by ARRL receive special benefits, including an announcement in these listings and online. Sanctioned conventions are also listed in *The ARRL Letter*. In addition, events receive donated ARRL prize certificates and handouts. Once the form has been submitted, your ARRL Director will decide whether to approve the date and provide ARRL sanction.

The deadline for receipt of items for this column is the **1st of the second month preceding publication date**. For example, your information must arrive at HQ by **July 1** to be listed in the **September** issue. Information in this column is accurate as of our deadline; contact the sponsor or check the sponsor's website for possible late changes, driving directions, and other event details. Please note that postal regulations prohibit mention in *QST* of games of chance, such as raffles or bingo.

Promoting your event is guaranteed to increase attendance. As an approved event sponsor, you are entitled to special discounted rates on *QST* display advertising and ARRL web banner advertising. Call ARRL's toll-free number at 1-800-243-7768, or email **ads@arrl.org**.

A Look Back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February, 1949
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radio
PUBLISHED BY THE AMERICAN RADIO RELAY LEAGUE

The Military Amateur Radio System

Army and Air Force Jointly Announce Postwar Training Program; Initially Open Only to Hams in Service and Reserves

THE first step toward the postwar renewal of traditional Army-amateur coöperation in a training program was accomplished in mid-December when the office of the Secretary of Defense announced the activation of the Military Amateur Radio System, for the present open

MAJOR GENERAL SPENCER B. AKIN
Chief Signal Officer
Department of the Army

only to amateurs in the military service or its reserves. MARS will be a joint project of the Air Force and the Army under the direction of Major General Francis L. Ankenbrandt, Air Force director of communications, and Major General Spencer B. Akin, chief signal officer of the Army.

Amateurs in military service, including those in overseas commands, or in the Organized Reserve Corps, National Guard or ROTC, are invited initially to apply for MARS membership to form a nucleus of a training project which, it is hoped, will soon be expanded to include civilian amateurs along the general lines of the prewar AARS. Application for membership may be made as detailed hereinafter. Commanding officers of each base, installation or other unit will, as soon as possible, each designate an officer to act as MARS director for his command.

The purposes of the Military Amateur Radio System are "to create interest and further training in military radio communication; to promote study and experimentation in military radio communication; to coördinate practices and procedures of amateur radio operations with those of military radio communication; and to provide an additional source of trained radio communication personnel in the event of a local or national emergency."

MARS will not operate on amateur frequencies. The System has obtained the use of special military frequencies for its drills — 3497.5, 6997.5, 14,405, 20,995 and 27,995 kc. — and crystals will be supplied members. Time on these net frequencies is equally divided between the Army and the Air Force and will be further apportioned by Army areas and Air Force subdivisions, with ample time left on all frequencies for "free" net operation. Top-level net control stations are WAR for the Army and AF4AF for the Air Force, both located in the Pentagon Building in Washington, D. C.

For general amateur operation outside of drill periods, amateur stations at military posts are being assigned calls with a "K" prefix, a numeral coinciding with the FCC amateur call area, and

MAJOR GENERAL FRANCIS L. ANKENBRANDT
Director of Communications
Department of the Air Force

suffixes of FAA through FZZ for the Air Force and WAA through WZZ for the Army. These calls are, of course, obtained by making the usual application on FCC Form 602. MARS member call signs will have an "A" prefix for Army and an "AF" prefix for Air Force, with numeral and suffix the same as the amateur call. Thus station K4AF becomes AF4AF when operating on MARS frequencies; W9USA would become A9USA when entering the regular Army net.

A considerable quantity of surplus electronic equipment has been allocated to MARS, to be made available to active and reserve units through usual channels, as specified in the joint announcement (SR 105-75-1 and AFR 102-3). The military proposes to sponsor amateur training in many types of communications and expects, for examples, that certain stations will conduct facsimile experiments on MARS frequencies and that MARS members, outside drill periods in amateur status, will enter 2-meter teletype nets. Amateur support will be asked in propagation studies, solving of u.h.f. communications problems, etc. A monthly bulletin to members will carry not only general news and operating notes but an occasional technical or construction article as well as antenna and propagation data. WAR will transmit an official bulletin each Monday simultaneously on 6997.5 and 14,405 kc., at 0100 and 0400 GCT.

An advisory committee is being appointed to assist the Chief Signal Officer and the Air Force Director of Communications on matters of policy pertaining to MARS. Early appointments to this committee are expected to be Major Rawleigh Ralls, W3RO, who has been designated MARS chief for the Air Force, and Captain Edward Nielsen, W4ODI, MARS chief for the Army (Signal Corps). ARRL has nominated its communications manager, F. E. Handy, W1BDI, as one of the civilian members of the MARS advisory committee.

And now, here's how to address applications for membership, assuming, of course, that you're in military service or the reserves and wish to become a "charter" member of MARS. In certain Air Force commands (FEAF, USAFE, SAC, AMC, ATC and ATRC) applications will follow command channels, addressed to the Commanding General of the particular command to which the applicant is attached, marked to the attention of the Chief, MARS. In other Air Force units and in the Army the applicant will be governed by his geographical location, as shown below:

N. Y. *Vt.* *N. H.* *Me.* *Mass.* *Conn.* *N. J.* *Del.*	First Army Headquarters Commanding General, First Army Governor's Island New York, N. Y., Attn.: Signal Officer *or* Commanding General Headquarters, First Air Force Fort Slocum, New York, Attn.: MARS, Air Force Director
Pa. *Ind.* *Ohio* *Ky.* *W. Va.* *Md.* *Va.* *D. C.*	Second Army Headquarters Commanding General, Second Army Fort George G. Meade, Maryland, Attn.: Signal Officer *or* Commanding General, Headquarters 14th Air Force Langley Air Force Base Langley Field, Virginia, Attn.: MARS, Air Force Director
Tenn. *N. C.* *S. C.* *Miss.* *Ala.* *Ga.* *Fla.*	Third Army Headquarters Commanding General, Third Army Fort McPherson, Georgia, Attn.: Signal Officer *or* Commanding General, 9th Air Force Greenville Air Force Base Greenville, South Carolina, Attn.: MARS, Air Force Director
Okla. *Texas* *N. M.* *Ark.* *La.*	Fourth Army Headquarters Commanding General, Fourth Army San Antonio, Texas, Attn.: Signal Officer *or* Commanding General, 12th Air Force Brooks Air Force Base San Antonio, Texas, Attn.: MARS Air Force Director
Wyo. *Colo.* *Kans.* *Neb.* *Mo.* *Iowa* *N. D.* *S. D.* *Minn.* *Wis.* *Ill.*	Fifth Army Headquarters Commanding General, Fifth Army Chicago, Illinois, Attn.: Signal Officer *or* Commanding General, 10th Air Force Fort Benjamin Harrison Indianapolis, Indiana, Attn.: MARS Air Force Director
Wash. *Ore.* *Calif.* *Nev.* *Ariz.* *Idaho* *Mont.* *Utah*	Sixth Army Headquarters Commanding General, Sixth Army San Francisco, Calif., Attn.: Signal Officer *or* Commanding General, Fourth Air Force Hamilton Air Force Base Hamilton Field, Calif., Attn.: MARS Air Force Director

Upon receipt of an inquiry for enrolment in MARS, the Signal Officer of the Army area or the MARS Air Force Director will forward application blanks to the applicant. When these are processed, a MARS call sign and net allocation will be made at the proper command level and a MARS certificate will be sent to adorn the walls of the "shack" alongside the FCC ticket.

A.R.R.L. ACTIVITIES CALENDAR

Feb. 4th: CP Qualifying Run — W6OWP
Feb. 11th–14th: DX Competition (c.w.)
Feb. 15th: CP Qualifying Run
Feb. 18th–21st: DX Competition ('phone)
Mar. 5th: CP Qualifying Run — W6OWP
Mar. 11th–14th: DX Competition (c.w.)
Mar. 16th: CP Qualifying Run
Mar. 18th–21st: DX Competition ('phone)
Apr. 3rd: CP Qualifying Run — W6OWP
Apr. 18th: CP Qualifying Run
Apr. 23rd–24th: CD QSO Party
May 6th: CP Qualifying Run — W6OWP
May 20th: CP Qualifying Run
June 3rd: CP Qualifying Run — W6OWP
June 4th–5th: V.H.F. Contest
June 15th: CP Qualifying Run
June 18th–19th: ARRL Field Day

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Jan. 1st–Dec. 31st: Most-States V.H.F. Contest

Celebrating Our Legacy

My Novice Homebrew Station

In February of 1957, I received my Novice-class license. It was a great time for ham radio because the solar cycle was phenomenal and the HF bands were wide open day and night. I had a crude homebrew station, which took many months to assemble. I was a young teenager with limited funds. When my license finally arrived from the FCC (it took 12 weeks), my station was complete.

It consisted of a 12 W 40-meter CW transmitter, which I built from an article I found in *Popular Electronics* magazine. It had one crystal (7175 kHz) and a 6AQ5 oscillator tube. The Novice band segment back then for 40 meters was 7150 – 7200 kHz. I had to build a power supply for the transmitter that provided 250 V for the tube's plate supply and 6.3 V for the filament. The receiver was a three-tube Knight Space Spanner regenerative receiver from Allied Radio (now known as Allied Electronics) and the antenna was a dipole. The receiver was broadbanded and seemed like I was hearing the entire Novice band with the tuning dial set in one position.

Hearing so many CW stations at once made it difficult to copy most of my contacts. I lost over half of my contacts, but I'll always remember my first one. I was living in the Boston area at the time, and after sending out countless calls, I finally heard my call sign. The station calling was KN2YXY (the "N" in the call sign prefix in those days indicated Novice class). He was from Freehold, New Jersey.

Wow, DX! My hand was shaking and my palm was sweaty as I tapped on my military surplus J-38 CW key. I was desperately trying to send my mailing address so I could get his QSL card, which I eventually did receive. I still have it. In fact, I still have my original Novice station. To me it's priceless, and it still works!

I decided to put it on the air during ARRL's Straight Key Night 3 years ago and had a nice contact with a station in Chicago. It was the first time I used this station since my very last Novice contact about 60 years ago. I felt transported back in time. Although, this time my hand wasn't shaking!

I'll always remember those exciting days when homebrew was a major aspect of our hobby. Unfortunately, most hams today will never experience the thrill of putting a home-built rig on the air. Our radios today are far more sophisticated than they were in the past. However, I'm glad ham radio is alive, and we are growing in number. I miss those early days, but I still enjoy my hobby.

Lew Nyman, K1AZE
Montgomery, Alabama

Lew Nyman's, K1AZE, homebrew station.

Steve Harris's, KF8KS, 1958 Knight Kit Span Master.

Preserving Memories in a Childhood Radio

My 1958 Knight Kit Span Master from Allied Radio sits in a place of honor in my shack. When I was 12 years old, I salvaged a radio in working order from a large Sears console. This "Silvertone" radio had shortwave dials marked with all sorts of listening possibilities. I was hooked.

It took about a year to save enough money to buy a Knight Kit Span Master, including the phones, antenna wire, lightning arrestor, and postage.

After many hours of careful construction, the Span Master worked on the first try! Although it did not perform as well as the old Silvertone, it awakened me to the magic of radio. Just two glass tubes, some wire, and other bits and pieces could be made to work wonders.

Twenty years ago, my Span Master still worked as well as it ever did, and I had a shack full of high-performance radios. Today, it doesn't light up. Do I go in and replace some of the original components that were so carefully placed by a 13-year-old 60 years ago? Perhaps it's best to let those memories rest in peace.

Steve Harris, KF8KS
Troy, Michigan

Send reminiscences of your early days in radio to "Celebrating Our Legacy," ARRL, 225 Main St., Newington, CT 06111 or **celebrate@arrl.org**. Submissions selected for publication will be edited for space and clarity. Material published in "Celebrating Our Legacy" may also appear in other ARRL media. The publishers of *QST* assume no responsibility for statements made in this column.

Harold Kramer, WJ1B, kramer.harold@gmail.com

Classic Radio

Military Telegraph Keys

During various wars, military telegraph operators needed keys that were rugged, adaptable to environmental conditions, and that had interchangeable parts that were easily serviced. Military keys needed to operate in dangerous environments, with lots of interference. These keys came in dark colors so they didn't reflect light in concealed environments, and some even needed to be water- and dustproof. Along with keys for operations, the military also needed keys for training purposes.

US military keys were labelled with the letter "J," indicating that the key was used by "joint" military services, paired with a nonconsecutive number ranging from 2 through 51 (i.e., J-2). US Navy keys used prefixes starting with the letter "C," followed by a set of letters that indicated the manufacturer. US military keys had service identification marks stamped in red onto their bases or the metal on the key itself. Here are some of the straight (hand) keys used by the military, although they sometimes used semi-automatic keys, such as the J-36.

The Most Popular Key

One of the most popular military hand keys ever manufactured, the J-38, is still used by many hams. It was a training key produced by multiple companies. Collectors seek out those manufactured by the Lionel Corporation, an electric novelties company known for toy trains and model railroads.

J-38s had thin, flat bases and, strangely enough, a metal strap between the two binding posts at the back of the key. These connected to a set of headphones and a training set. Many J-38s had small screw eyes at the back of the base, where a string was threaded to hold them on the table during training exercises. For more details about J-38 keys, visit **https://k6ix.net/J38Keys.html**.

Nonexplosive Keys

It was challenging to send CW in an environment containing gunpower, diesel fuel, and other chemicals that could ignite from a spark. The US Army Signal Corps Flameproof Aircraft Telegraph Key Model J-5-A, manufactured by the now defunct L.S. Brach Manufacturing Company of Newark, New Jersey, is an example of a key used in this type of setting. Its contacts were fully enclosed and sealed, so there was no danger of a spark. Except for its mushroom knob, the key was completely made of metal. The electrical connections were made to the heavy-duty binding posts on the rear of the key. Its side arm lever had an unusual curvature to accommodate the sealed mechanism.

Another flameproof key was the lightweight, compact US Navy Flameproof Telegraph Key Model CMI-26003A, used throughout World War II. The letters "CMI" indicate that it was made by the Molded Insulation Company. Like the J-5-A, it had enclosed contacts to eliminate the possibility of an explosion from a spark. The lever was attached to the contacts with a unique **U**-shaped bracket. Steel binding posts for electrical connections were mounted on the top of the key. Like most US Navy keys, it had a mushroom-shaped knob.

The unusual-looking British Royal Air Force (RAF) "Bathtub" key was used in World War II by paratroopers on British Lancaster bombers. Its contacts were completely enclosed to

▲ One of the most popular military hand keys ever manufactured was the J-38.

▼ The British Royal Air Force (RAF) "Bathtub" key.

prevent sparks. The largest of the three knobs on the top of the key was for sending CW, and the two smaller knobs were screw-thread electrical connectors. The top of the key was hinged, and the electrical parts of the key were mounted upside down inside the case. The metal-clip knob kept the cover tightly closed, but it could be slipped over the knob to hold it down in order to send out a continuous signal for rescue and location efforts.

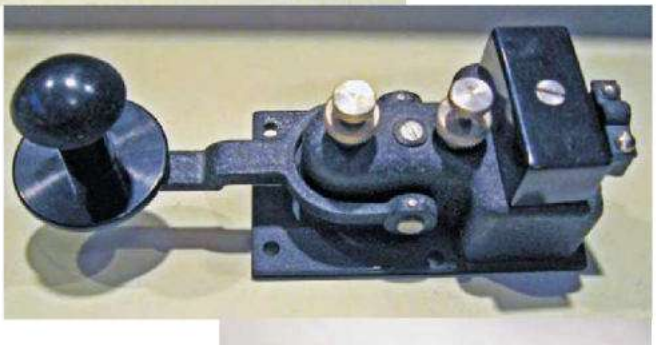
Another approach to enclosing key contacts was the large Soviet Army TKF key that was manufactured in Cherkasy, Ukraine. The rugged TKF key weighed almost 1 pound. The case was made of heavy-duty plastic. A metal plate on the bottom of the base could be attached to the operator's desk. The key lever had two sets of contacts: one for normally open and one for normally closed operation. TK "F" models had an RF filter on the bottom of the case to further eliminate sparks and induced currents in high-RF environments.

Attachable Keys

The tiny British McMurdo Telegraph Key was manufactured by McMurdo Industries (now known as Orolia Maritime) from the 1950s to the 1970s. It was about 2 inches long and 1½ inches wide. It had a 2-inch-wide canvas strap threaded through its metal base that could be attached to the operator's leg. It was fully enclosed to prevent sparks and was waterproof, so it could be used on life rafts. This key was used by the British military with their manpack portable transceivers.

Another key with an attached canvas strap was the 1960s and 1970s vintage Jardillier miniature telegraph key. These tiny keys were only 3 inches long and 1¼-inch wide. They were made in Issy-les-Moulineaux, France, and were manufactured for the French military, the French Foreign Legion, and the French Post Office. This key was not fully enclosed, but it had a black metal cover that slid back over the key to allow for adjustments.

◀ The US Army Model J-51 telegraph key looked like a pair of scissors.



▶ The lightweight, compact US Navy Flameproof Telegraph Key Model CMI-26003A.

The tiny British McMurdo Telegraph Key, just 3 inches long and 1¼ inch wide.

The US Military J-45/J-37 was designed to hold a J-37 key steady in a moving vehicle, such as a tank or an airplane. It had a heavy-duty **U**-shaped leg clamp with a metal hinge attached to the back of the key's base. The clamp was attached to an operator's legs, presumably to hold the key steady. (I've tried it and it actually works!)

The J-45 clamp base used a J-37 telegraph key and was a real workhorse for the military. It was a rugged, compact key that was used from World War II through the Vietnam War. There were many variants of the J-45. They were mounted on at least five different bases and used for both landline and radio telegraphy.

Although it looked like a pair of scissors, the US Army Model J-51 telegraph key was used with a signal lamp. There was no telegraph lever or springs. The operator squeezed the two pieces of metal together to complete the circuit. The electrical connections were the two push terminals on the bottom of the key. I can't imagine sending CW quickly with this key! It came with a long cable so the operator could stand far away from the signal light to avoid being the target.

These and many other types of military keys can still be found at hamfests and on auction websites. In my experience, these are inexpensive and still-usable telegraph keys, which allows today's hams to own a part of telegraphic history.

All photos provided by the author.

Al Brogdon, W1AB

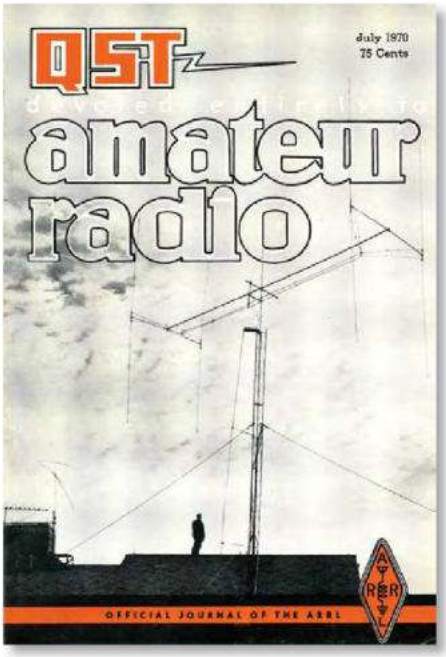
100, 50, and 25 Years Ago

July 1920

- The cover shows the home of ARRL President Hiram Percy Maxim, 1AW.
- The editorial, "Lost — A 1920 Summer Season," reports on continued ham activity and less static, rather than the usual summer doldrums.
- "The A.R.R.L. QSS Tests" details the investigation of the curious phenomenon of fading, with lists of the test's transmitting stations and their schedules, for hams to listen and file reports.
- L.C.F. Horle presents a report on current "Navy Receiving Equipment."
- Howard L. Stanley discusses his early experiments, in "C.W. for the Amateur."
- John O.G. Cann, Chief Engineer of the Marconi Wireless Telegraph Company of Canada, writes about "The 'V-24' Triode Valve."

July 1970

- The cover photo shows W8JK admiring his five-band rotary beam array, described in the issue.
- The editorial, "NSIN," discusses the use of amateur bands by the National Student Information Network.
- Douglas Blakeslee, W1KLK, shares an extensive update of a popular VHF transceiver, in "The '70 Communicator."
- Robert Holloway, W4USQ, explains the causes and methods of the location of "Power-Line Interference," a serious problem that many hams face.
- Lew McCoy, W1ICP, explains how to build a versatile antenna tuner that he calls "The Ultimate Transmatch."
- Robert Stoffels discusses the operation of transistor circuits in Part 9 of "Let's Talk Transistors."
- In "Eclipse Experiment-1970," R.R. Schellenbach, W1JF, reports on the "instant night-time conditions" that occurred along the path of the total eclipse of the sun.
- William Sabin, WØIYH, explains potential design problems and their solutions in order to get high performance from "The Solid-State Receiver."
- The "Recent Equipment" column examines the Drake TR-6 50-MHz Transceiver.



July 1995

- The cover photo shows WA6ITC's custom-designed, solar-powered home, with a combination ham shack and astronomical observatory.
- In the editorial, "A Club Challenge," David Sumner, K1ZZ, shares how the Southern Michigan Amateur Radio Society donated all of their 1996 club dues to the AMSAT Phase D Project, and challenges other clubs to do the same.
- Kirk Kleinschmidt, NTØZ, takes readers through "The Pavek Museum of Broadcasting," in Saint Louis Park, Minnesota.
- Rudy Severns, N6LF, explains how to build "A Wideband 80-Meter Dipole" that's simple and inexpensive. The design is reminiscent of some of the ham antennas of the early days of radio.
- Denton Bramwell, K7OWJ, reports on "A Continuously Variable Bandwidth Audio Filter" that he built.
- In "Voice-Track — A Multifunctional, Talking Repeater Controller — Part 2," Alexander Bonello, LW2EET, demonstrates how to install the controller in your repeater system.
- Steve Bible, N7HPR, and Greg Pool, WH6DT, present Part 2 of "Amateur Radio on the World Wide Web."
- Steve Ewald, WV1X, tabulated information to provide the "1994 Simulated Emergency Test Summary."
- "Yachting in Kansas," by Deborah Brauser, NØKZR, shares how two clubs joined together to put a World Championship yachting race on the air.

Silent Keys

It is with deep regret that we record the passing of these radio amateurs:

•W1BR **Prince**, Roger H., Princeton, MA
N1DX **Corson**, John P. "Jack," Chiang Mai, Thailand
K1EHW **Peters**, George J., Norwalk, CT
•KB1FCB **Bliss**, George W., Athol, MA
N1IQL **Duquette**, Richard W., Leicester, MA
•KB1JVO **Botting**, Joy C., Smyrna Mills, ME
KC1LEI **Boudreau**, Douglas A., Farmington, NH
N1LT **Christopher**, Richard P. "Dick," Laconia, NH
♦K1LU **McCobb**, James E., Jr., West Newbury, MA
KW1NES **Hamilton**, Bob S., Westmoreland, NH
♦W1RCW **Webb**, Raymond C., Foxboro, MA
K1SEZ **Ciezniak**, Paul J., Wallingford, CT
WA1TRK **Graham**, Gerald R., Avon, CT
WA1WLA **Thomas**, Constantine, Stamford, CT
W2DGI **Sartor**, Donald R., Montvale, NJ
K2EE **Gravel**, David R., Milford, PA
KC2ESU **Altamuro**, Joseph D., White Plains, NY
W2GPK **Kennedy**, Gerard P., Bushnell, FL
•WB2HWZ **Henrich**, Kenneth J., Landing, NJ
W2JVM **Slaaen**, Harold T., Toms River, NJ
♦K2MFY **Whitman**, Edward A., Plainview, NY
KC2MHE **Hoyle**, Robert A., Deerfield, NY
WB2NBJ **Schnapp**, Raymond G., Glendora, NJ
K2OKT **Boyack**, Robert A., Lady Lake, FL
♦W2PG **Kincaid**, Wallace B. "Wally," Victor, NY
KA2POP **Melenbacker**, Eric R., Rochester, NY
♦N2RB **Baycar**, Raymond E., Allentown, PA
KA2TTE **Emmich**, Richard, Roseland, NJ
♦K2URM **Hager**, Warren P., Hillsdale, NJ
WA2UON **Kienzle**, John F., Nassau, NY
K2UVU **Weiss**, Olgierd J., Jr., "Augie," Canton, NY
N2XQK **Colish**, John L., Stratford, CT
W2YBP **Thompson**, James C., Waretown, NJ
KC3CJW **McCullough**, Frances, New Port Richey, FL
N3EFN **Fuller**, Bernard E., Saegertown, PA
W3IEZ **Flesch**, Robert L., Gilbert, AZ
K3MR **de Rouville**, Matthew M., Toms River, NJ
N3NY **Gregory**, Joseph J., Rensselaer, NY
N3OUK **Scott**, Herbert J., Jr., Philadelphia, PA
W3PDY **Yeates**, Paul D., Alburtis, PA
WG3R **Robinson**, Curtis Lee, La Plata, MO
•KB3UGL **Rowland**, James S., Morton, PA
K3WMH **Montgomery**, Robert E., Akron, PA
KB3YA **McIntyre**, Michael B., Arnold, MD
W3YOZ **Johnson**, Martin E., Churchton, MD
N4AJF **Swanson**, Lee H., Apex, NC
♦W4AMH **Gardberg**, David James, Mobile, AL
WA4BDP **Phillips**, Charles T., Sr., Kennesaw, GA
W4BG **Gray**, Robert A., Loudon, TN
AB4CT **Turpin**, Patricia Jean, Jackson, TN
K4DCT **Drury**, Roy D., Riverview, FL
W4DLZ **Thrash**, Frank W., Crawfordville, FL
N4DSE **Morgan**, Betty M., Jonesborough, TN
W4DWT **Tart**, David Walker, Hinesville, GA
KI4EDG **Collier**, Janet E., Hawkinsville, GA
KV4FZ **Schoenbohm**, Herbert L., Christiansted, VI
K4GB **Sleeman**, James T., Lawrenceville, GA
K4GIM **Carretta**, Joseph, Jr., Springfield, VA
♦K4HTV **Hartley**, Gary W., Deming, NM
K4LTA **O'Kain**, Bill, Oak Ridge, TN
KA4MBM **Hauser**, Vivian J. "Jackie," Fort Myers, FL
K4MTJ **Mcleod**, Thelma J., Ladson, SC
K4MZY **Holcomb**, Sigmond W., Jr., Wilkesboro, NC
•KC4NQB **Duesselmann**, Gail, Naples, FL
W4NWL **Emmons**, David L., Winter Park, FL
KB4OGD **Feuer**, Edwin, Altamonte Springs, FL
AB4OP **Pruitt**, William C., Madison, IN
N4PDA **Smith**, Earnest H., Dayton, TN
KB4QBO **Carter**, Peyton L., II, Chattanooga, TN
KA4RPA **Davis**, Virgil H., Knoxville, TN
KE4RUG **Beauchat**, Augustus M. "Big Mac," Savannah, GA
♦WE4SI **Frysinger**, James R., Spencer, TN
WB4STQ **Cavender**, William J., Elon, GA
K4TDG **Shockley**, Joel E., Jr., Chester, SC
KD4UCO **Witzig**, Eric Warren, Springfield, VA
•K4VBA **McDaniel**, Tom S., Sr., Cordova, TN
KU4W **Kelchner**, William E., Jr., Raeford, NC
KV4WZ **Vandiver**, Ronald E. "Ron," Clarkesville, GA
KD4YEL **Leininger**, Mitchell F., Colonial Heights, VA
W4ZD **Luse**, Marvin W., Jr., Gainesville, GA
K5AOL **Castlebury**, Bobby, Brookston, TX
W5BIY **Kuehn**, James A., Cedar Park, TX
KE5EQU **Renfrow**, Gary W., Oklahoma City, OK
W5EUT **Jennings**, James W., Colorado Springs, CO
AG5F **McAtee**, Robert, Abilene, TX
KD5FOY **Clark**, Larry D., Richardson, TX
W5JAD **DeMars**, Donald A. "Don," Leander, TX
KA5LQM **Kennedy**, Gustavus A., Pasadena, TX
K5LVN **Lewis**, Ethel M., San Antonio, TX
WA5MPW **Bartlett**, Evelyn W., Beaumont, TX
WA5MZS **Humble**, Calvin W., Copperas Cove, TX
KB5NAJ **Bateman**, Earl Y., Jr., Dallas, TX
KB5OVJ **Hoover**, Walter G., Silsbee, TX
KC5OVY **Gray**, Curtiss G., Bells, TX
AF5TR **Witheford**, Peter S., Anacortes, WA
•W5UBG **Garling**, John W., Jr., New Albany, MS
KF5UWW **Largent**, Noel S., Whitehouse, TX
•W5UYA **Chadwick**, Charles F. "Chad," Grand Prairie, TX
•W5WS **Sanford**, Wayne H, Jr., Warrington, PA
N5ZVU **Glick**, Jonathan M. "Jon," Livingston, TX
K6AWR **Franklin**, Hubert J. "Jim," McCloud, CA
KD6EUJ **Schauppner**, Paul R., Berkeley, CA
K6FM **Moller**, Jan K., Colfax, WA
WA6GEL **Kelty**, Robert, San Jose, CA
KD6HVT **Ivy**, Rodney D., Cherry Valley, CA
KF6JQI **Schriebman**, Harry, Corte Madera, CA
N6KP **Harris**, Theodore A. "Ted," Oakdale, CA
WB6LVP **Shore**, J. Neville, Jr., "Jay," Pleasanton, CA
K6SX **Fults**, Richard N., Placerville, CA
WB6THU **Matthews**, Henry B., Jr., Dallas, TX
♦N6UN **Bourke**, Kenneth P., San Diego, CA
♦W6YD **Allan**, George A., Los Banos, CA
KB7AVB **McLaughlin**, Michael Charles, West Valley City, UT
♦W7EJS **Sabo**, Ernest J., Jr., "Joe," Bothell, WA
KC7GLJ **Beach**, Russell F. "Ray," Cottonwood, AZ
WZ7H **Swiney**, Earl R., Bonney Lake, WA
KD7II **Doolittle**, Marion W., Vancouver, WA
N7LAR **Bales**, Larry L., Las Vegas, NV
N7MBB **Taft**, Myrna J., Lake Havasu City, AZ
N7NYB **Berg**, Larry S., Jerome, ID
♦WA7PHI **Anderson**, Michael K. "Kriss," North Bend, OR
KF7QGG **Schuyler**, Michael L., Glendale, AZ
AA7QK **Spencer**, Nicholas E., Mesa, AZ
KA7SWA **Truman**, Kevin S., Parowan, UT
W7UXB **Bilan**, James A., Las Vegas, NV
WA7UZG **Dickeson**, Robert C., Lewiston, ID
W7VVW **Simmons**, Dean P., Ephrata, WA
♦KB8AI **Druyor**, Gerald R., Dearborn Heights, MI
WD8AVW **Hull**, Robert A., Omaha, NE
KD8BTR **Whittaker**, Leonard E., Niles, MI
WD8BWK **Seidelman**, John S., Holland, MI
K8CCG **Swett**, Robert A., Muskegon, MI
KC8DEY **Kistler**, John J., Newcomerstown, OH
W8KFJ **Kennett**, David W., North Ridgeville, OH
•KD8LZ **Hastings**, James M., Kalamazoo, MI
K8MEF **Bussell**, David D., Crystal River, FL
W8OHT **Sherrick**, John, Waldorf, MD
WB8RCR **McDonough**, John J., Midland, MI
AB8RW **Wiltshire**, Raymond S. "Ray," Loveland, OH
KB8TLS **Clarke**, Robert J., Columbus, MS
•W8VPZ **Percel**, William E. "Jim," Troy, OH
♦AJ8Y **Chaney**, Dennis F., Findlay, OH
KC8YOK **Fogle**, David L., Flushing, MI
KA9DKF **Bond**, Ronald R., Mammoth Springs, AR
K9DL **Hohenberger**, James R., Crete, IL
KV9J **Thompson**, David H., Onalaska, WI
K9MPX **Pschirrer**, Harold D., Canton, IL
K9NM **McKain**, Norman F., Anderson, IN
♦WB9NTL **Rueth**, Kenneth M., Centerville, IN
•WA9OYL **Collins**, Herbert D. "Dave," Peachtree City, GA
W9OZY **Northup**, Eugene R., Elk Grove Village, IL
•K9POE **Poe**, Kenneth W., Greenwood, IN
KA9SKF **Williams**, Kenneth R., Hammond, IN
W9SLP **Preflatish**, Steven L., English, IN
N9SLU **Aydelotte**, James D., Linton, IN
N9UDO **Schulze**, Steven E., Baraboo, WI
WB9UQE **Litwin**, Randy T., Frankfort, IL
KC9UX **Boyer**, Garryl W., Lebanon, IN
KØDEW **Wheeler**, Bill J., Lebanon, MO
KEØFVO **Rayfield**, Danny R., Raymore, MO
KAØGMZ **Wiersma**, Daniel J., Coon Rapids, MN
♦KDØGOA **Olds**, Theresa, Salt Lake City, UT
KØIEW **Ellis**, Vernie L., Kansas City, KS
KAØIJY **Keene**, Keith L., Bellevue, NE
ADØJD **Scurlock**, Roger S., Winfield, MO
KAØKPY **Muns**, Warner, Sioux Falls, SD
WAØKS **Carver**, Richard D., Shawnee, KS
WØKWJ **Snowdall**, Roger J., Raytown, MO
NØODA **Freeman**, Joseph P., San Antonio, TX
WØOO **Moore**, Ernest P., Jr., Ballwin, MO
KAØPII **Haskins**, Larry D. "Dean," Colorado Springs, CO
WØSED **Hancock**, Alan C., Kansas City, KS
WØSLL **Cutitta**, Joseph, Phoenix, AZ
WAØWHE **Ellingson**, Gary L., Moorhead, MN
VE3WBN **Ashcroft**, Bruce H., Norwich, ON, Canada
GM3WIL **Cossar**, Dave, Prestwick, Ayrshire, Scotland

In the February 2020 column, John A. Hodurski's, KN4YUL, name was misspelled. We apologize for the error.

♦ Life Member, ARRL
• Former call sign

For information on how to list a Silent Key in *QST*, please visit **www.arrl.org/silent-key-submission-guidelines**.

Note: Silent Key reports must confirm the death by one of the following means: a copy of a newspaper obituary notice, a copy of the death certificate, or a letter from the family lawyer or the executor. Please be sure to include the amateur's name, address, and call sign. Allow several months for the listing to appear in this column.

Many hams remember a Silent Key with a memorial contribution to the ARRL Foundation or to ARRL. Contributions to the Foundation are tax deductible to the extent permitted under current tax law. Our address is: The ARRL Foundation Inc., 225 Main St., Newington, CT 06111.

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FTDX101MP | *200W HF/50MHz Transceiver*

• Hybrid SDR Configuration • Unparalleled 70 dB Max. Attenuation VC-Tune • New Generation Scope Display 3DSS • ABI (Active Band Indicator) & MPVD (Multi-Purpose VFO Outer Dial) • PC Remote Control Software to Expand the Operating Range • Includes External Power With Matching Front Speaker

FTDX3000 | *100W HF + 6M Transceiver*

• 100 Watt HF/6 Meters • Large and wide color LCD display • High Speed Spectrum Scope built-in • 32 bit high speed DSP /Down Conversion 1st IF

FT-991A | *HF/VHF/UHF All ModeTransceiver*

Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO

FTDX101D | *HF + 6M Transceiver*

• Narrow Band SDR & Direct Sampling SDR • Crystal Roofing Filters Phenomenal Multi-Signal Receiving Characteristics • Unparalleled - 70dB Maximum Attenuation VC-Tune • 15 Separate (HAM 10 + GEN 5) Powerful Band Pass Filters • New Generation Scope Displays 3-Dimensional Spectrum Stream

FT-891 | *HF+50 MHz All Mode Mobile Transceiver*

Rugged Construction in an Ultra Compact Body • Stable 100 Watt Output with Efficient Dual Internal Fans • 32-Bit IF DSP Provides Effective and Optimized QRM Rejection • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control

FTM-300DR | *C4FM/FM 144/430MHz Dual Band*

• 50W Reliable Output Power • Real Dual Band Operation (V+V, U+U, V+U, U+V) • 2-inch High-Res Full Color TFT Display • Band Scope • Built-in Bluetooth • WiRES-X Portable Digital Node/Fixed Node with HRI-200

FT-2980R | *Heavy-Duty 80W 2M FM Transceiver*

• Massive heatsink guarantees 80 watts of solid RF power • Loud 3 watts of audio output for noisy environments • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users

FTM-7250DR | *C4FM/FM 144/430MHz Dual Band*

• 50 Watt Mobile • System Fusion-II Compatible • Operates Advanced C4FM Digital & Conventional FM Modes • 3 Watt Powerful & Clear Audio with Front Speaker

FTM-400XD | *2M/440 Mobile*

• Color display-green, blue, orange, purple, gray • GPS/APRS • Packet 1200/9600 bd ready • Spectrum scope • Bluetooth • MicroSD slot • 500 memory per band

FT-70DR *C4FM/FM 144/430MHz Xcvr*

• System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output • Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging

FT-3DR *C4FM/FM 144/430 MHz Xcvr*

• High Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Simultaneous C4FM/C4FM Standby • Micro SD Card Slot

FT-65R | *144/430 MHz Transceiver*

Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flashlight, Alarm and Quick Home Channel Access

FT-60R | *2M/440 5W HT*

• Wide receiver coverage • AM air band receive • 1000 memory channels w/alpha labels • Huge LCD display • Rugged die-cast, water resistant case • NOAA severe weather alert with alert scan

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IC-9700 | *All Mode Tri-Band Transceiver*

• VHF/UHF/1.2GHz • Direct Sampling Now Enters the VHF/UHF Arena • 4.3" Touch Screen Color TFT LCD • Real-Time, High-Speed Spectrum Scope & Waterfall Display • Smooth Satellite Operation

IC-7851 | *HF/50MHz Transceiver*

• 1.2kHz "Optimum" roofing filter • New local oscillator design • Improved phase noise • Improved spectrum scope • Dual scope function • Enhanced mouse operation for spectrum scope

IC-7700 | *HF/50MHz Transceiver*

The Contester's Rig • HF + 6m operation • +40dBm ultra high intercept point • IF DSP, user defined filters • 200W output power full duty cycle • Digital voice recorder

IC-7610 | HF/50 MHz *All Mode Transceiver*

• Large 7-inch color display with high resolution real-time spectrum scope and waterfall • Independent direct sampling receivers capable of receiving two bands/two modes simultaneously

IC-7300 | *HF/50MHz Transceiver*

• RF Direct Sampling System • New "IP+" Function • Class Leading RMDR and Phase Noise Characteristics • 15 Discrete Band-Pass Filters • Built-In Automatic Antenna Tuner

IC-718 | *HF Transceiver*

• 160-10M** • 100W • 12V operation • Simple to use • CW Keyer Built-in • One touch band switching • Direct frequency input • VOX Built-in • Band stacking register • IF shift • 101 memories

IC-705 | HF/50/144/430 MHz *All Mode Transceiver*

• RF Direct Sampling • Real-Time Spectrum Scope and Waterfall Display • Large Color Touch Screen • Supports QRP/QRPp • Bluetooth® and Wireless LAN Built-in

IC-7100 | *All Mode Transceiver*

• HF/50/144/430/440 MHz Multi-band, Multi-mode, IF DSP • D-STAR DV Mode (Digital Voice + Data) • Intuitive Touch Screen Interface • Built-in RTTY Functions

IC-2730A | *VHF/UHF Dual Band Transceiver*

• VHF/VHF, UHF/UHF simultaneous receive • 50 watts of output on VHF and UHF • Optional VS-3 Bluetooth® headset • Easy-to-See large white backlight LCD • Controller attachment to the main Unit

IC-2300H | *VHF FM Transceiver*

• 65W RF Output Power • 4.5W Audio Output • MIL-STD 810 G Specifications • 207 alphanumeric Memory Channels • Built-in CTCSS/DTCS Encode/Decode • DMS

ID-5100A Deluxe

VHF/UHF Dual Band Digital Transceiver

• Analog FM/D-Star DV Mode • SD Card Slot for Voice & Data Storage • 50W Output on VHF/UHF Bands • Integrated GPS Receiver • AM Airband Dualwatch

ID-4100A | *VHF/UHF Dual Band Digital Xcvr*

• Compact, Detachable Controller for Flexible Installation • DV/FM Near Repeater Search Function • Apps for iOS™ and Android™ devices • Wireless Operation with VS-3 & UT-137 Bluetooth® Headset & Module • MicroSD Card Slot

IC-V86 | *VHF 7W HT*

• 7W OutputPower Plus New Antenna Provides 1.5 Times More Coverage • More Audio, 1500 mW Audio Output • IP54 & MIL-STD 810G–Rugged Design Against Dust & Water • 19 Hours of Long Lasting Battery Life • 200 Memory Channels, 1 Call Channel & 6 Scan Edges

IC-R30 | *Digital/Analog Wideband Xcvr*

• 100 kHz to 3.3 GHz Super Wideband Coverage • P25 (Phase 1), NXDNTM, dPMRTM, D-STAR Mode • 2.3" Large LCD Display & Intuitive User Interface • MicroSD Card Slot for Voice & Data Storage • USB Charging & PC Connection

IC-PW1 | *HF/50 MHz Amplifier*

• Wide freq. coverage - 1 kW from 1.8 MHz to 50 MHz (amateur bands only) • Wide ALC adjustable range • Full duty cycle • Auto antenna tuner built-in • Auto AC input voltage selector is employed

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*The antenna and antenna connector in the photo are after-market products.

New

HF/50/144/430 MHz <SSB/CW/RTTY/AM/FM/DV> 10 W TRANSCEIVER

- **HF/50/144/440 MHz Multimode, including the D-STAR DV Mode**
- **RF Direct Sampling System**
  * The down-conversion IF sampling method is used for 25 MHz and above.
- **Real-Time Spectrum Scope and Waterfall Display**
- **Large Touch Screen Color Display**
- **Compact and Lightweight Design** * Approximately 1.1 kg, including the battery pack.
- **BP-272 Battery Pack or 13.8 V DC External Power Source**
- **Maximum Output Power 5 W (BP-272), 10 W (13.8 V DC)**

Making your field operation more fun and stylish

Multi-Function Backpack LC-192

Supplied Accessories

HM-243 Speaker-microphone, BP-272 Li-ion Battery Pack, OPC-2421 DC Power Cable

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hy-gain® HF Rotators

HAM-IV – $709.95

The Most Popular Rotator in the World!

For medium communications arrays up to 15 square feet wind load area. Has 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced movement. North/South center of rotation scale on meter, low voltage control, max mast $2^{1}/_{16}$".

HAM-VI – $809.95 with DCU-2
HAM-VII – $959.95 with DCU-3

HAM IV and HAM V Rotator Specifications	
Wind Load Capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**Dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs**

TAILTWISTER SERIES II – $869.95

For Large Medium Antenna Arrays up to 20 sq. ft. wind load.

Has 5-second brake delay, Test/Calibrate functions. Low temp grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, $2^{1}/_{16}$" max mast. **MSHD, $139.95**. Above tower heavy duty mast support. T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$-$2^{5}/_{8}$" OD.

T-2XD2 – $979.95 with DCU-2
T-2XD3 – $1039.95 with DCU-3

TAILTWISTER Rotator Specifications	
Wind Load Capacity (inside tower)	20 square feet
Wind Load (w/mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs**

CD-45II – $499.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter.

Low temperature grease good to -30 F degrees. New Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45D2 – $599.95 with DCU-2
CD-45D3 – $659.95 with DCU-3

CD-45II Rotator Specifications	
Wind Load Capacity (inside tower)	8.5 square feet
Wind Load (w/mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs**

New!

Hy-Gain Programmable DCU-3 Digital Rotator Controller

DCU-3 – $499.95

Hy-gain DCU-3 Digital Controller lets you program 6 beam headings! Gives you full automatic or manual control of your hy-gain HAM or Tailtwister Rotators.

Press a memory button or dial in your beam heading or let *Ham Radio Deluxe* (or other) take control. Your antenna auto rotates precisely and safely to your DX.

DCU-3 automatically jogs your antenna free and safely unlocks it before rotating begins (*great for older rotators with "sticky" brakes*) then turns off your motor before reaching its final heading. Your antenna gently coasts to a stop before the brake re-locks -- greatly reducing damaging overshoots and extending rotator life.

Simply press *Left* and *Right* buttons for full manual control and fine tuning.

Bright blue LCD shows current, dialed in and computer controlled beam headings in one degree increments and your call.

Calibrate lets you accurately match your display to your true beam heading. Has USB/RS-232 ports for computer control. Adjustable LCD sleep time. Field upgradeable firmware. 8.5Wx4.3H x9D".

110 VAC. Order DCU-3X for 220 VAC.

DCU-2 Digital Rotator Controller – $459.95
Like DCU-3, but less programmable memories. 110 VAC. Order **DCU-2X**, for 220 VAC.

AR-40 – $399.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area.

Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind Load Capacity (inside tower)	3.0 square feet
Wind Load (w/mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs**

Replace your Yaesu Rotator Controller

YRC-1 – $369.95

Hy-gain YRC-1 -- more features, more robust, far less prone to lightning damage. Costs less than repairing!

Easy-to-use -- dial in your beam heading and tap GOTO button. Exclusive 180 degree *AutoReversal*™ for fast longpath operation. All DCU-2 features. Bright blue LCD shows current, dialed-in, computer controlled beam headings, call. USB port for computer control. Extra heavy-duty AC power supply. Fast variable DC motor minimizes overshoot. Intuitive menu. Field upgradeable. For Yaesu G-800/1000/2800/G450/650. AC or DC motors.

YRC-3, $449.95. Like YRC-1 and adds 6 memories.

AR-500 Rotator/Controller – $169.95

UHF/VHF/6-Meter, MFJ-1886 Rotator/Controller and Remote. For use of small VHF/UHF, 6M, TV, FM, the MFJ-1886 wide band receiving loop and other light-weight ham antennas. Rotator is built in a weather-proof one piece cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote, clamps, and all hardware.AR-500 remembers up to 12 directions even after a power outage! Use remote control or direct console. Displays location and relative position.

hy-gain® **Antennas, Rotators & Towers** 308 Industrial Pk Rd, Starkville, MS 39759 USA
Sales/Tech: (662) 323-9538 ■ **FAX:** (662) 323-5803 Open 8-4:30 CST, Mon.-Fri.

MFJ G5RV Antennas

Operate all bands 10 through 160 Meters with a single wire antenna!

***The famous** G5RV antenna is the most popular ham radio antenna in the world!*

It's an efficient, *all* band 102 foot long antenna – shorter than an 80 Meter dipole. Has 32.5 foot ladder line matching section ending in SO-239 connector for your coax feedline.

MFJ-1778
$69.95

Use horizontally or as Inverted Vee or Sloper with just one support. 1500 Watts.

Operate all bands 80-10 Meters with an antenna tuner and even 160M with ground.

Fully assembled with *ceramic* end and fiberglass center insulators. *Hang and Play*™ – add coax, rope to hang and you're on air!

MFJ-1778M, $59.95. *Half-size,* 52 foot *G5RV JUNIOR for limited space*. 40-10 Meters with tuner. Full 1500 Watts.

MFJ All Band Classic Doublet

MFJ 102 foot *all band* doublet covers 160-6 Meters with balanced line tuner. Super strong custom fiberglass center insulator relieves stress on 100 foot ladder line. *Glazed ceramic* end insulators. 1500 Watts.

MFJ-1777
$79.95

RF Isolator

MFJ-915 *RF Isolator* prevents unwanted RF from traveling on the outside of your coax shield into your transceiver. This unwanted RF can cause painful RF "bites" when you touch your microphone or volume control, cause your display or settings to go crazy, lock up your transceiver or turn off your power supply. In mobile installations, stray RF could cause your car to do funny things even blow your car computer. Clear up these problems, plug an MFJ-915 between your antenna and transceiver. 1.8-30 MHz, 1500 Watts. 5 x 2 inches.

MFJ-915
$39.95

MFJ-919, $69.95. 4:1 current balun,1.5 kW.
MFJ-913, $39.95. 4:1 balun, 300 Watts.

True 1:1 Current

Balun & Center Insulator

True 1:1 *Current Balun/Center Insulator* forces equal radiator currents in dipoles for true dipole radiation pattern. Reduces coax radiation and field pattern distortion – your signal goes where *you* want it. Reduces TVI, RFI and RF hot spots. *Don't build a dipole without one!* 50 hi-permeability ferrite beads on high quality RG-303 *Teflon*® coax and *Teflon*® SO-239. 1.5kW 1.8-30 MHz. Stainless steel hardware. 14 gauge stranded copper wire is *directly* connected to your antenna. 5 x 2 inches. Heavy duty weather housing.

MFJ-918
$39.95

2-Position Antenna Switch

MFJ-1702C, $49.95. 2-position antenna switch, lightning surge protection, center ground. SO-239s.

Lightning surge protectors

MFJ-270, $24.95. 400W. **MFJ-272, $34.95.** 1500 W. Gas discharge tube shunts 5000 amps peak.< 0.1 dB loss. 1 GHz. SO-239s.

MFJ-16C06, $9.45. 6-pack *glazed ceramic* end/center ant. insulators.

MFJ-16B01, $24.95. Molded high strength center insulator. SO-239.

MFJ-16D01, $9.95. 450 Ohm fiberglass end/center insulator with ladder line stress relief and SO-239 mount.

MFJ-18H100, $44.95. 100 feet, 450 Ohm ladder line, 18 gauge copper clad.

80-10 Meter End-Fed Half Wave antenna

Cover all bands with one single wire and no tuner!

MFJ-1982HP
$109.95

No tuner needed!
All band 80-10M EFHW antenna

Get-on-the air on all bands 80-10 Meters with just one wire and one support (pole or tree) and no tuner or long counterpoise.

Installs anywhere in minutes! Rugged *insulated*-wire radiator prevents detuning when contacting limbs/branches. "*No-snag*" end insulator slides over branches, leaves.

Toss over a high limb for inverted-V or sloper or go vertical with an inverted-L.

Dark jacketed wire is virtually invisible – *don't let antenna restrictions keep you off the air!* Great for emergencies.

EFHWs naturally resonate on the 1/2-wave fundamental frequency and odd/even harmonics. Covers 80/40/30/20/17/15/12/10 Meters without traps, stubs or resonators.

Broad-band matching transformer at feed point gives SWR so low you may never need a tuner. Compensating inductor optimizes SWR. 800 Watts SSB/CW. 132 feet jacketed antenna wire.

MFJ-1984HP, $89.95. Like MFJ-1982HP but 40-10M. 66 feet jacketed wire.

See *www.mfjenterprises.com*
for 30 Watt QRP and 300 Watt models.

Dual Band Dipoles

MFJ-17758, $99.95. Operate 80/40 Meters with a short 85 foot dipole. Full-size on 40 Meters with ultra-efficient end-loading on 80 Meters. 1500 Watts. Super-strong custom molded center insulator with SO-239 connector and hang hole. Ceramic end insulators. 7-strand, 14 gauge hard copper wire. No tuner needed!

MFJ-17758
$109.95
80/40 Meters

MFJ-17754, $69.95. Like MFJ-17758 but is only 42 feet. Operate 40/20 Meters. Full-size on 20 Meters, ultra-efficient endloading on 40 Meters. 1500 Watts.

Single Band Dipoles

Ultra high quality center fed dipoles give years of troublefree service. Custom injection-molded UV resistant center insulator has built-in SO-239 and hanging hole. Glazed ceramic end insulators. 7-strand, 14-gauge hard copper antenna wire. 1500 Watts. Use horizontally or as sloper or inverted vee. Simply cut to length with provided cutting chart.

MFJ-1779A
$79.95
160M, 265 ft.

MFJ-1779B
$59.95
80-40M, 135 ft

MFJ-1779C
$39.95
20-6M, 35 ft.

OCFD Dipoles

MFJ-2012
$89.95
1500 Watts

MFJ-2010
$69.95
300 Watts

No tuner needed!
MFJ *Off-Center Fed Dipoles* use MFJ's exclusive *ExactRatio*™ RF broadband transformer to give low SWR and maximum bandwidth on 40/20/10/6 Meters. A Guanella current balun kills feedline radiation, pattern distortion, SWR shifts, RFI and noise pickup. Install anywhere and get the same predictable performance regardless of feedline length. You get ground reinforced gain over verticals. Use horizontally, inverted vee, sloper. 98% efficient, 14 gauge, 7-strand copper wire, ceramic end insulators.

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Excellent quality, no bargain basement stuff here. Adapters & connectors for most types of connections.

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Premium Bury Flex, USA-400 & USA-240 coax jumpers with your choice of UHF, Type N, BNC, SMA, TNC & Mini-UHF Connectors.

HAMMO-CAN™ Go Box

Ready to go, a complete VHF-UHF station in a box. Get them with or without radios installed. Fits most FM mobiles & several HF radios, too.

New Item!! HybridDX™ HF antenna. Get on 80M in less than 80 ft.

www.qsradio.com

MFJ Cobweb Antenna

6-Bands: 20/17/15/12/10/6 M...Outstanding Performance!

Restricted space spoiling your operating fun? MFJ Cobweb puts your call back on the map!

This six-band (20, 17, 15, 12, 10, 6 Meters) full half-wave *Cobweb Antenna* is perfect for restricted space or portable operation. Sky-gray fiberglass spreaders and *nearly invisible* wire elements (flat 9 x 9 x 1/2 feet square. 8 pounds), blend in with your surroundings while standing tough against nasty weather.

Outstanding performance! Horizontally polarized for less local noise pickup plus solid gain over verticals will allow you to work DX easily – even on QRP. Omni-directional. No radials needed! Works great at low heights. Low SWR is due to MFJ's exclusive *Spider-Match*™ broadband network. Use lightweight TV hardware to mount on your chimney, balcony, mast.

Low in cost, but big on performance. MFJ *Cobweb Antenna* turns your space problem into a stack of QSL cards from far away places.

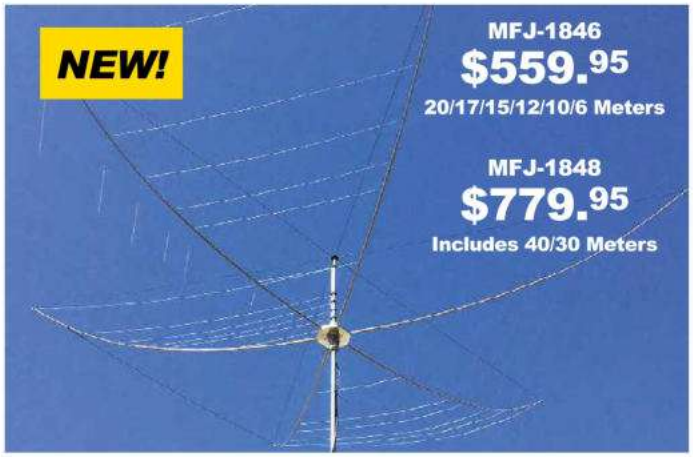
MFJ-1836HK34, $139.95. Add-on kit adds 40/30 Meters to MFJ-1835/1835H and MFJ-1836/MFJ-1836H cobweb antennas.

MFJ-1838
$459.95

40-6 METER Cobweb Super Heavy-Duty, 1.5 kW

New! Super heavy-duty 40-6 Meter Cobweb Antenna. Built to survive harsh northern winters, heavy snow, ice and strong winds – has super-strong large diameter fiberglass and heavy-duty 14 gauge stranded hard copper wire. 8-bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters, 1500 Watts. Turning radius: 12 feet, 23 lbs.

MFJ 20/17/15/12/10/6 Meter *Hexbeam*



New MFJ HexBeams deliver solid gain and directivity on 20/17/15/12/10/6 Meters with two elements on each band.

MFJ uses an updated G3TXQ element configuration for excellent gain, improved bandwidth, superior front-to-back ratio and low SWR!

MFJ takes the HexBeam`s unique balanced-tension framework to a new level with rugged mounting hardware, exceptionally durable spreaders and sliding antenna-wire guides – designed to ensure years of reliable service.

MFJ-1846, $559.95. 6 Bands: 20/17/15/12/10/ 6M, 2-elements per band, full 1500W. 25 lbs. 11 ft.turning radius.

MFJ-1848, $779.95. 8 Bands: 20/17/15/12/10/ 6M, 2-elements per band; 40/30M, single elements, full 1500W. 28 lbs. 14 ft. turning radius.

www.mfjenterprises.com

3-Element Hexbeam

MFJ-1856 is ***six*** individually stacked monoband yagis!

6 Bands: 20/17/15/12/10/6M. Full 1500 Watts.

Three *full-size* elements on each band gives high gain, high front-to-back ratio and wide bandwidth. Works great at 20 feet. 30lbs. 17 feet turning radius. Ideal for a small rotator like hy-gain's CD-45II, $449.95.

MFJ Isolator and 1:1 Balun

MFJ-915, $39.95 Stop *RF* traveling down coax line, painful RF "bites" and erratic operation. 1.5 kW 1.8-60 MHz. 2W x 5H". SO-239s.

MFJ-918, $39.95 True 1:1 Current balun & center insulator forces equal antenna currents in dipole elements.

MFJ Dry Dummy Load

MFJ-260C, $49.95. Air-cooled, 300 Watt dry dummy load with a noninductive resistor in a perforated metal housing. SO-239 connector. Full load 30 seconds. Silk-screened derating curve to 5 minutes. SWR below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz.

MFJ 2-Pos. Antenna Switch

MFJ-1702C, $49.95. 2-position antenna switch has center ground, auto grounding of unused position, handles 2.5 kW PEP and works to over 500 MHz. Lightning surge protection. Quality SO-239 connectors, heavy duty diecast.

MFJ-1704, $109.95. Like MFJ-1702C but has 4 positions.

MFJ G5RV Antenna

MFJ-1778, $69.95. G5RV antenna covers 160-10 Meters with antenna tuner. 102 ft. long. Inverted vee or sloper. Use on 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center/feed-point insulators. Glazed ceramic end insulators. Hand-soldered. Add coax, some rope and you're *on the air!*

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3rd IMDR 110 dB*

RMDR 122 dB*

BDR 150 dB*

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- Rob Sherwood - NC0B - December 2018

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Top-class receiving performance

3 kinds of dynamic range make for top-class performance.

- Third order intermodulation Dynamic Range (3rd IMDR) 110dB*
- Reciprocal Mixing Dynamic Range (RMDR) 122dB*
- Blocking Dynamic Range (BDR) 150dB*

*Values are measured examples. (2kHz spacing:14.1 MHz, CW, BW 500 Hz, Pre Amp OFF)

- Full Down Conversion RX
- High Carrier to Noise Ratio 1st LO
- H-mode mixer

4 kinds of built-in roofing filters

500Hz / 2.7kHz / 6kHz / 15kHz (270Hz Option)

7 inch Color TFT Display

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- Band scope auto-scroll mode
- Multi-information display including filter scope

Clean and tough 100W output

Built-in high-speed automatic antenna tuner

32-bit floating-point DSP for RX / TX and Bandscope

*: 2 kHz spacing measurement standard - Receiver frequency 14.2 MHz, MODE CW, BW 500 Hz, PRE AMP OFF

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www.kenwood.com/usa

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ADS#02019

MFJ *Magnetic Loop* Antennas

MFJ 36-inch magnetic loop antenna lets you operate 7 to 22 MHz or 10 to 30 MHz continuously -- including the WARC and MARS bands! Easily handles a full 150 Watts on SSB/CW/Digital for any transceiver.

Ideal for limited space -- apartments, small lots, motor homes, attics, or mobile homes.

Work exciting DX with low angle radiation and local close-in contacts with high angle radiation when mounted vertically.

Super easy-to-use! MFJ remote control auto tunes to your desired band. Fast/slow tune buttons, Cross-Needle SWR/Wattmeter lets you quickly tune to your exact frequency. No control cable needed.

***World's** most efficient small loop antenna has all welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter aluminum radiator -- gives you highest possible efficiency.*

Every capacitor plate is welded for extremely low loss and polished to prevent high voltage arcing. Nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor gives smooth precision tuning. Heavy-duty ABS plastic housing has ultraviolet inhibitor protection.

MFJ-1782, $459.95. Like MFJ-1786 but with fast/slow tune manual remote control.

MFJ-1780, $369.95. 20-10 Meters, 150 Watt *Portable 24x24x24" box fan loop with carrying handle.* Highly efficient all-welded contstruction, no-rotating contact butterfly capacitor. Fast/slow tune remote control. No control cable needed. *See QST July 2019 review.*

MFJ-1780XX, $449.95. Like MFJ-1780 with auto band tune remote control, SWR/Wattmeter.

Build your own Mag loop!

Motorized Butterfly Capacitors

Super low loss butterfly capacitors, no rotating contacts, all plates welded with no mechanical electrical contacts. Anti-backlash mechanism. DC motor with gear reduction box. Handles at least 150 Watts SSB/CW/Digital.

1. **p/n: 282-1786, $189.95.** 11-128 pF.
2. **p/n: 282-1788, $249.95.** 15-260 pF.
3. **p/n: 80-1786-2SM, $249.95.** Auto band selecting remote controller with SWR/Wattmeter.
4. **p/n: 80-1782-2, $79.95.** Manual remote control, fast/slow tune buttons.

Butterfly Capacitors

5. **MFJ-19, $79.95.** 12-67 pF.
6. **MFJ-23, $109.95.** 18-136pF.
7. **p/n: 729-0142, $19.95.** 6:1 vernier gear reduction drive for loop tuning capacitor.

8. 36-inch Aluminum Circular Loop with Integrated welded capacitor and mast mounting brackets
p/n: 10-1786-11, $129.95. 1.05 inch OD heavy duty tubing.

See MFJ Youtube reviews at: *https://m.youtube.com/results?search_query=mfj*

MFJ Magnetic Loop Tuners, 150 Watts

Turns any wire loop into a small, high efficiency multi-band transmitting magnetic loop antenna! Work the world on 3.5 to 30 MHz with a full 150 Watts SSB/CW/Digital. No ground, radials or counterpoises needed. Very quiet receiving antenna -- you'll hardly notice static crashes. High-Q reduces QRM, overloading, harmonics. Perfect for apartments, antenna restricted areas and portable operation.

A 13' wire loop covers 30-20 Meters (4' for 17-10M; 7' for 20-15M; 28' for 60-40M; 50' for 80M). Tune *any* shape loop -- circle, square, rectangle, *etc.*

A wire length gives about 1.5 to 1 frequency range (i.e.7-10, 18-28 MHz).

MFJ low loss *Butterfly* loop tuning capacitor has no rotating contacts. *Easy-Carry* handle. Mount for PVC Cross loop support on cabinet top.

MFJ-936B, $299.95. Antenna current meter, Cross-Needle SWR/Wattmeter. 9¼Wx5½Hx9½D inches.

MFJ-935B, $249.95. Antenna current meter. 6¼Wx5½Hx9½D inches.

MFJ-933, $209.95. 6¼Wx5½Hx9½D".

MFJ Low-Noise Receiving Mag Loop

Clearly hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static disappears. Rotating MFJ-1886 eliminates interfering signals or greatly peaks desired signals. Excellent antenna and preamplifier balance gives deep null. Gives excellent strong and weak signal performance without overload. Fully protected state-of-the-art push-pull Gali MMICs preamplifier gives you high dynamic range, low IMD and 25 dB of low noise gain. Use inside or outside.

QRP Mag Loop Tuner

MFJ-9232
$69.95

Turns wire around a bookcase, window, tree, etc. *into a small, high efficiency transmitting loop antenna!* Operate 40-10 Meters with included flexible wire loop (80/60 Meters with your bigger loop). No counterpoises, radials, ground needed. 25 Watts. Very quiet reception. Hi-Q reduces QRM, overload, harmonics. Great for apartments, antenna restrictions, portable ops.

VIDEOS: https://m.youtube.com/results?search_query=MFJ-9232

Antenna Rotator

Perfect for magnetic loops, VHF/UHF, small HF beams, TV, FM antennas. Weather-proof cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote control, clamps, hardware. 12 Memories. Digital display. 110/220 VAC.

AR-500
$169.95

MFJ Tripods/Masts

Strong, black *steel* triangular braced base. Non-skid feet, strong mast locks.

MFJ-1919, $109.95, Supports 100 lbs. Extends a *whopping* 7.8 ft. Base spreads up to 4.8 sq. ft. 1.4" dia. mast. Collapses to 54" by 6" diameter. 9¾ lbs.

MFJ-1919EX, $179.95. Tripod *plus* mast. 18' extended. 5' collapsed. 1/8" wall, 3/4" dia. top, 1½" dia. bottom.15 lbs.

MFJ-1918, $69.95, 6'extended. 38" collapsed, 6¾ lbs.

MFJ-1918EX, $109.95. Small tripod with extension mast. 9½', 3.8 ft. collapsed. ¾"top, 1" bottom. 6.5 lbs.

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MFJ ANTENNAS

MFJ Wire Antennas

G5RV -- *Most popular antenna in the world!*

Operate 80-10 or 40-10M with tuner. 14 gauge, 7-strand copper antenna wire. 1.5kW. 32.5' ladder line matching section with SO-239 for coax.
MFJ-1778, $69.95. 80-10M. 102 feet long.
MFJ-1778M, $59.95. 40-10M. 52 feet long.

End Fed Half Waves

Operate 80-10 or 40-10M with one support/no tuner.
80-10 Meters, 132 feet:
MFJ-1982HP, $109.95. 800 Watts.
MFJ-1982MP, $79.95. 300 Watts.
MFJ-1982LP, $59.95. 30 Watts.
40-10 Meters, 66 feet:
MFJ-1984HP, $89.95. 800 Watts.
MFJ-1984MP, $69.95. 300 Watts.
MFJ-1984LP, $49.95. 30 Watts.

Off Center Fed Dipoles

Lightweight, virtually invisible. Gives you directivity and gain (*see MFJ website*).
MFJ-2012, $89.95, 40/20/10/6 Meters, 1500 Watts. 67 ft.
MFJ-2010, $69.95. 40/20/10/6 Meters, 300 Watts. 67 ft.
MFJ-2014, $119.95. 75/40 Meters, 1500 Watts. 122 ft.
MFJ-2016, $149.95. 160/75/40 Meters, 1500 Watts. 240 ft.
MFJ-2013, $89.95. 60/30 Meters, 300 Watts. 86 ft.

Dual Band 80/40 or 40/20 Dipoles, 1.5 kW

MFJ-17758, $109.95. 80/40 Meters, 95 feet long, ultra-efficient end-loading on 80 Meters. No tuner needed. Super-strong center insulator, built-in SO239, hanghole.
MFJ-17754, $69.95. 40/20M, 42 ft.

MFJ All Band Doublet

MFJ-1777, $79.95.102 foot, 160-6 Meters with tuner/balun. *Extremely low feedline loss.* Super strong fiberglass center insulator provides stress relief for included 100 feet ladder line. *Ceramic* end insulators. 1500 Watts SSB/CW/Digital.

MFJ 1.5 kW Dipoles

7-strand, 14-ga. copper wire.*Ceramic* insulators. Center insulator with SO-239
MFJ-1779C, $39.95. 20-6M, 35 feet.
MFJ-1779B, $59.95. 80-40M,135 feet.
MFJ-1779A, $79.95. 160M, 265 feet.

20M Extended Double Zepp

MFJ-1742, $99.95. See web for gain. 90 ft. long, 100 ft. ladder line. 7-strand, 14-ga. wire. 80-10M with tuner/balun. 1500 Watts SSB/CW/Digital.

80M End-Fed Zepp

MFJ-1748, $99.95. 125 feet long, 100 foot ladder line included. 7-strand, 14-ga. wire. Use tuner/balun. 1500 Watts SSB/CW/Digital.

MFJ-915, $39.95 RFI Isolator

Prevents unwanted RF from traveling on your coax shield into your expensive transceiver. Prevents painful RF "bites" and erratic operation. 1.5 kW. 1.8-30 MHz.

MFJ-918, $39.95 4:1 Balun

True 1:1 current balun/center insulator. High-permeability ferrite beads on RG-303 *Teflon*(R) coax. 2" dia.x6" long. 14 gauge 7-strand copper wire. 1.5 kW 1.8-30 MHz.

MFJ-913, $39.95, 300W MFJ-919, $69.95, 1.5 kW

True 4:1 current baluns/antenna center insulators transform 200 ohms to 50 ohms, 1.8-30 MHz. Transmission line transformer, low permeability ferrite cores, SO-239, stainless steel hardware with direct 14 gauge stranded copper wire to antenna.

MFJ Vertical Mounted Antennas

MFJ 6-Band Cobweb Antenna

MFJ-1836H, $299.95. Six-bands: 20/17/15/12/10/6 Meters, 1.5 kW. *Perfect for restricted space*. Nearly invisible. 9x9x1/2 feet, 8 lbs. Outstand-ing performance! Horizontally polarized gives less noise, more gain over verticals. Omni-directional. No radials needed! Works great at low heights. Low SWR.
MFJ-1836, $269.95. Like MFJ-1836H, but 300 Watts.

MFJ *4-Band* Dipole Octopus Antenna

Octopus *antenna hub turns hamsticks into four balanced* HF/VHF/UHF *dipoles!* Rotate for maximum signal, minimum QRM/noise. Mount low for local NVIS, high for DX. Perfect for portable, limited space, HOAs, camping, ARES. Balun. No tuner needed.
MFJ-2104, $289.95. Includes 8 hamsticks for 75/40/20/15 M.
MFJ-2100, $119.95. Hub only. Use eight hamsticks.

MFJ Multi-Band Verticals, no radials needed!

Low angle radiation lets you easily work far-away, rare DX!
Efficient end loading gives maximum radiated power.
1500 Watts SSB/CW/Digital. Low SWR. Omni-directional. No radials or antenna tuner needed.
Low profiles blend into any surroundings. Mount them anywhere ground level, roof tops, apartments, houses, small lots.
Efficient high-Q coils. High power air-wound choke balun.
Built-to-last. Solid fiberglass rod, aircraft aluminum tubing.
5 models: Choose your bands 80-2 Meters
MFJ-1796, $339.95. 6 bands: 40/20/15/10/6/2M, 12 feet.
MFJ-1797, $369.95. 7 bands:40/30/20/17/15/12/10M. 23 ft.
MFJ-1797LP, $339.95. Like MFJ-1797, but only 9 feet tall. Narrower bandwidth on 40 Meters.
MFJ-1799, $449.95.10 bands: 80/40/30/20/17/15/12/10/6/2M. 20 ft.
MFJ-1799X, $399.95. Like MFJ-1799, but less 80M.

MFJ 43-foot Vertical, 160-6 Meter

MFJ-2990,$399.95. High performance 43 foot vertical operates 160-6 Meters, 1500 Watts SSB/CW/Digital. 2 square feet wind load. Self-supporting, no guy wires needed. 6063 aircraft aluminum tubing, bottom section 2" OD, .120" wall thickness. 20 lbs. Requires antenna tuner, ground/counterpoise.

BigStick ™ Vertical

MFJ-2286, $119.95. 7-55 MHz, *full 1/4 wave* 20-6M, 40M coil. 17 ft. extended, 28" collapsed. 2 lbs. 1 KW. Mount, radial kit included.

BigEAR ™ Dipole

MFJ-2289, $209.95. 7-55 MHz. *Full-size* 20-6 Meter dipole, 40M air loading coil. Two 17 ft. telescopic whips, 28" collapsed.

Lightning surge protectors

MFJ-270, $24.95. 400W.
MFJ-272, $39.95. 1500W. Gas discharge tube shunts 5000 amps peak.< 0.1 dB loss. 1 GHz. SO-239s.

2-Position Antenna Switch

MFJ-1702C, $49.95. 2-position antenna switch, lightning surge protection, center ground.

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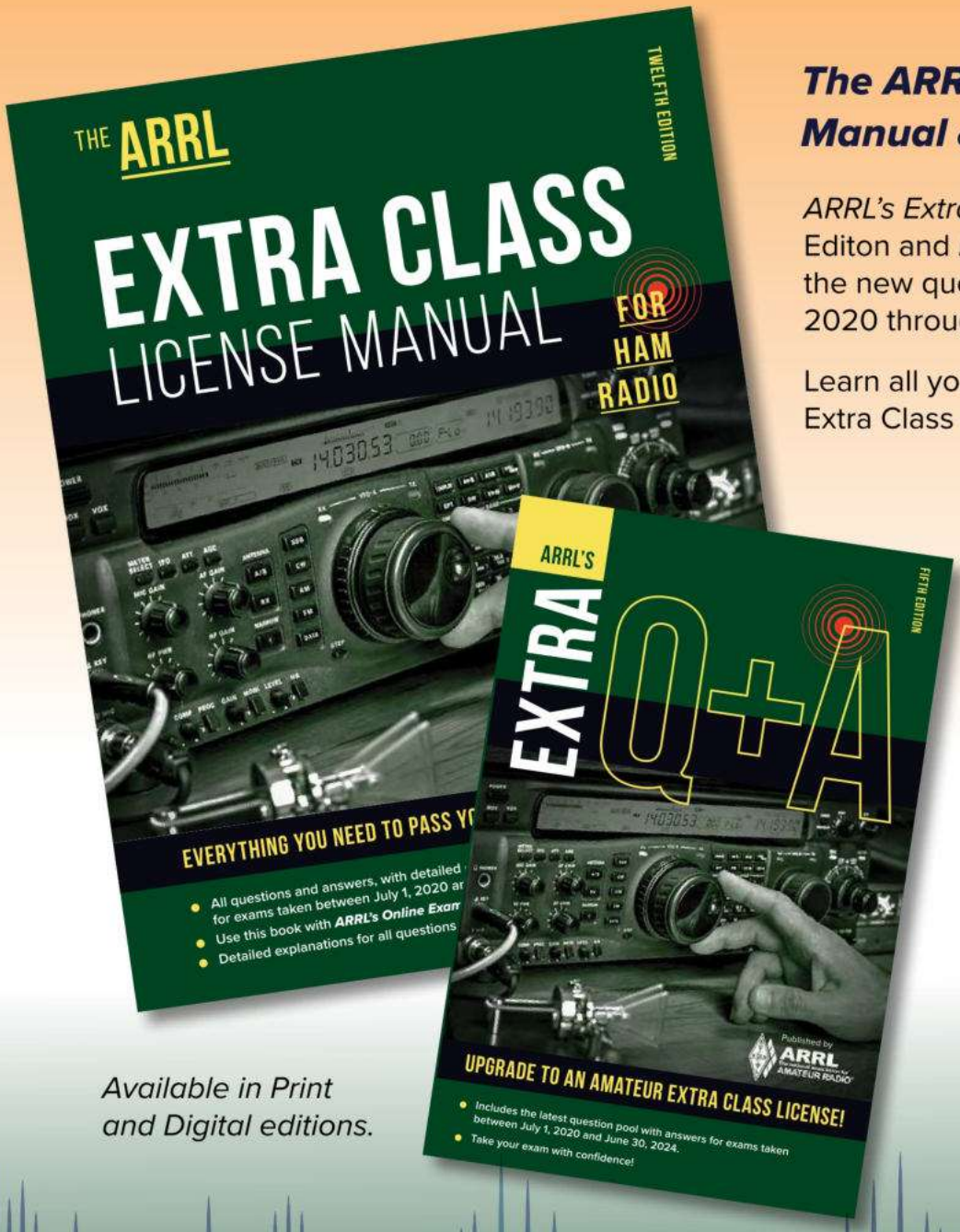

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TESTIMONIALS

"...you can't go wrong with these books. They are well-written and designed to teach you the material, not merely prep you for the exams."

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"The books are organized in a way that makes learning the material easy. ARRL has online test-taking that you can use free, so review is simple. "

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MFJ...the World Leader in Ham Radio Accessories!

MFJ Weather-Proof Window Feedthrough Panels

Weather-proof window feedthrough panels bring coax, balanced lines, HF/VHF/UHF antennas, random wire antennas, ground, rotator/antenna switch cables and DC/AC power into your hamshack without drilling through walls!

MFJ Weather-Proof Window Feedthrough Panels mount in your window sill. Lets you bring all your antenna connections into your hamshack without drilling holes through walls.

Simply place in window sill and close window. One cut customizes it for any window up to 48 inches. Use horizontally or vertically. Connectors are mounted on inside/outside stainless steel plates and attached to a 4 foot long, $3^1/_2$ inch high, $^3/_4$ inch thick pressure-treated wood panel.

Real Western Red Cedar wood is naturally resistant to rot, decay and insects -- lasts longer, maintenance-free. Pitch and resin free for a wide range of beautiful finishes or leave it in its naturally beautiful raw finish. Edges sealed by weather-stripping. Seals and insulates against all weather conditions. Includes window locking rod.

Inside/outside stainless steel plates ground all coax shields. Stainless steel ground post brings ground in.

MFJ-4603 Universal Window Feedthrough Panel

MFJ-4603
$109.95

Four 50 Ohm Teflon® SO-239 coax connectors lets you feed HF/VHF/UHF antennas at full legal power limit.

A 50 Ohm Teflon® coax N-connector lets you use any antenna up to 11 GHz, including 450 MHz, UHF, satellite, moon bounce and 2.4/5.8 GHz Wi-Fi antennas.

A 75 Ohm, 1 GHz F-connector makes it easy to bring in television, Satellite, HD, cable TV and FM radio signals.

A pair of high-voltage ceramic feedthru insulators lets you bring in 450/300 Ohm balanced lines directly to your antenna tuner.

Has random/longwire antenna ceramic feedthru insulator.

5-way binding posts lets you supply 50 Volts/15 Amps DC/AC power to your outside antenna tuners/relays/switches.

Stainless ground post brings in ground connection, bonds inside/outside stainless steel panels together and drains away static charges.

MFJ's exclusive Adaptive Cable Feedthru™ lets you bring in rotator/antenna switch cable, etc. without removing connectors (up to $1^1/_4$ X $1^5/_8$ in). Adapts to virtually any cable size. Seals out rain, snow, adverse weather.

3 Coax, Balanced Line, Random Wire

Best Seller! 3 Teflon® coax connectors for HF/VHF UHF antennas. Separate high voltage ceramic feed-thru insulators for balanced lines and longwire/random wire, Stainless steel ground post.

MFJ-4602
$79.95

6 Coax

6 high quality Teflon® coax connectors for HF/VHF/UHF antennas. Stainless steel ground post. Full 1500 Watt legal limit.

MFJ-4601
$69.95

4 Balanced Line, 2 Coax

4 pairs of high-voltage ceramic feed-thru insulators for balanced lines and 2 coax connectors.

MFJ-4600
$89.95

5 Cables, any-size

5 Adaptive Cable Feedthrus™. Pass any cable with connector: 2 cables with large connectors up to $1^1/_4$ x $1^5/_8$ inches and 3 cables with UHF/N size coax connectors. Seals out weather.

MFJ-4604
$114.95

All-Purpose FeedThru/CableThru™

Stacks MFJ-4603 and MFJ-4604! Gives you every possible cable connection you'll ever need through your window without drilling holes in wall – including UHF, N and F coax connectors, balanced lines, random wire, ground, DC/AC power and cables of any size for rotators, antenna switches, etc.

MFJ-4605
$179.95

Bring cables through the eave of your house

MFJ-4616
shown with standard full size vent (not included) it replaces. For 6 Cables
$34.95

MFJ-4613
shown with standard half size vent (not included) it replaces. For 3 Cables
$19.95

Replace your standard air vents on the eave/sofitt of your house with these MFJ AdaptiveCable™ Air Vent Plates and...

Bring in coax, rotator, antenna switch, power cables, etc. with connectors up to $1^1/_4$ x $1^5/_8$ inches!

Sliding plates and rubber grommets adjust for virtually any cable size to seal out adverse weather, insects and varmints. Use existing vent hole, mounting screws and screw holes.

AdaptiveCable™ Wall Plates

MFJ-4614
For 4 Cables
$44.95

Bring nearly any cable -- rotator, antenna switch, coax, DC/ AC power, etc. -- through walls without removing connectors (up to $1^1/_4$x$1^5/_8$ inches). Sliding plates and rubber grommets adjust hole size to weather-seal virtually any size cable.

Includes stainless steel plates for each side of wall, sliding plates, rubber grommets, weather stripping and screws.

MFJ-4612
For 2 Cables
$34.95

MFJ-4611
For 1 Cable
$19.95

Free Dealer/Catalog/ Manuals/Instructions – Visit: www.mfjenterprises.com or call toll-free 800-647-1800

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Phone: (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

MFJ Analyzers

MFJ-259D...World's Most Popular Antenna Analyzer!

MFJ-259D
$319.95

Super easy-to-use!

Dual analog meters, LCD – New and improved, now covers 280 KHz-230 MHz plus 2200 Meter band!

NEW!

World famous MFJ-259D gives you a complete picture of your antenna's SWR and Complex Impedance.

MFJ-259D is a complete ham radio test station including – frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance/Reactance Analyzer, Coax Analyzer, Capacitance/Inductance Meter and more!

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

Determine velocity factor, coax cable loss in dB, length of coax and distance to short/open.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously.

MFJ No Matter What™ Warranty

Every MFJ Analyzer is protected by MFJ's famous one year **No Matter What**™ limited warranty. We will repair or replace your MFJ analyzer (at our option) for a full year.

Read inductance (uH) and capacitance (pF) at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

Built-in frequency counter, Ni-MH/Ni-CD charger circuit, battery saver, low battery warning, smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial – just like your transceiver. SWR and Complex Impedance are displayed instantly!

Fully portable, take it anywhere – remote sites, up towers, on DX-peditions. Use 10 AA or Ni-Cad or Ni-MH batteries (not included) or 110 VAC with **MFJ-1312D, $19.95**. Rugged metal cabinet only 4 x 2 x 6 3/4 inches.

MFJ-249D, $299.95.

If digital display is all you need MFJ-249D does everything MFJ-259D does without analog meters.

More hams use MFJ analyzers than all others in the world!

MFJ-269D

280 KHz - 230 MHz *plus* 415-470 MHz, 280-230 MHz plus 2200Meters!

MFJ-269D
$419.95

NEW!

MFJ-269D is a *super* MFJ-259D that adds 415-470 MHz and 12-bit A/D converter that gives you much better accuracy. *Complex Impedance Analyzer* reads series/*parallel* equivalents and magnitude/phase *CoaxCalculator*™ gives line length from electrical degrees and vice-versa for any frequency, Velocity Factor, coax loss in dB. Use any characteristic impedance 10-600 Ohms. Has LCD log SWR bargraph, N-connector.

MFJ-223

1-60 MHz Color Graphic VNA Analyzer

MFJ-223
$339.95

This *pocket-sized* wonder breaks the mold for analyzer design with user-friendly convenience, top notch accuracy, and a vivid TFT multi-color display. Don't let the size fool you, MFJ-223 is packed with all the VNA features and performance you need!

- **Single-frequency** and *swept-frequency* operating modes
- **Truly accurate** SWR, R, X, and Z measurements
- **Seamless DDS** coverage with 280-Hz resolution from 1-60 MHz
- **Smooth "skip-free"** encoder tunes fast or slow without missing a step
- **Powerful +5-dBm** stimulus generator overrides local interference
- **Field-strength meter** measures local signals, detects potential interference
- **DDS generator** precision signal source
- **Vivid 1600-pixel/inch** color graphics on a 2x2 inch non-glare TFT screen

MFJ-225

1.5-180 MHz *continuous* Two-Port Graphic Analyzer

MFJ-225
$339.95

Out in the field, MFJ-225 is a compact completely *self-contained handheld graphing analyzer*. On the bench it becomes a full-fledged two-port (S21) desktop machine when teamed up with your PC. Using powerful IG-miniVNA freeware, you'll run detailed data analysis and print out stunning color-graphic plots to document your work!

Built-in back-lighted *3-inch LCD graphic* display. Make fine adjustments using fullscreen easy-to-view SWR bargraph, capture vivid swept displays for SWR, impedance, return loss, phase angle, more. DDS generator.

MFJ-269DPRO™ Analyzer

MFJ-269DPro, $459.95

Like MFJ-269D, but UHF range covers ***430 to 520 MHz*** to include commercial and industrial frequencies. Rugged protective shell protects knobs, switches, meters, digital display for commercial, industrial and lab work.

MFJ VNA Antenna Analyzer

MFJ VNA Antenna Analyzer covers 1 to 230 MHz, 1Hz resolution.

- ***Frequency sweep plots:*** *SWR, Impedance, Resistance, Reactance, Phase Angle, Complex Return Loss, Smith Chart*
- ***Sign of reactance*** positively identifies inductive or capacitive reactance
- ***Amazing accuracy with OSL (Open-Short-Load) calibration*** – calibrate through feedline/test cable at different frequencies and store in memory. Measure directly or through feedline with exceptional accuracy, correcting for line loss/phase angle. ***Smith Chart*** plots S11 magnitude/phase over any frequency span. ***Capture screens*** in 32 memories to download to PC via USB.

MFJ-226
$359.95

MFJ SWR Analyzer Accessories

A. **MFJ-29D/MFJ-39D, $39.95.** Carrying Pouch for MFJ-259D/269D.

B. **MFJ-92AA10, $39.95.** 10-Pack 2500 mAh Ni-MH Supercells.

C. **MFJ-66C, $39.95.** Dip coils, set of two covers 1.8-230 MHz.

D. **MFJ-731, $119.95.** Tunable Analyzer Filter, 1.8-30 MHz, for strong RF fields.

E. **MFJ-917, $39.95.** 1:1 Current balun for SWR Analyzers to test balanced line antennas, other loads.

F. **MFJ-5510, $15.95.** 12VDC cigarette lighter adapter.

G. **MFJ-7737, $9.95.** PL-259 to BNC Female.

H. **MFJ-7727, $9.95.** PL-259 to SMA Female.

MFJ Enterprises, Inc. 300 Industrial Pk Rd, Starkville, MS 39759
Phone: (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

SHELBY HAMFEST 2020

W4NYR SARC CLUB SHELBY AMATEUR RADIO CLUB

September 4–6, 2020

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YOUTH LOUNGE (Saturday) | SUNDAY SCHOOL AND BINGO (Sunday)

FOR MORE INFORMATION & TO ORDER TICKETS http://www.shelbyhamfest.org
PRE-REGISTRATION TICKETS $8.00 / TICKETS ARE $10.00 AFTER AUGUST 28

PRE—REGISTRATION PRIZE (Friday) IS AN **ICOM ID-51A PLUS 2 HT w/DSTAR**

MAIN PRIZES (Saturday & Sunday) **ICOM 7300 HF RADIO & GEOCHRON 4K WORLD CLOCK / TV**

BI-HOURLY PRIZES **ALINCO DUAL BAND HT's w/ DMR**

YOU DO NOT HAVE TO BE PRESENT TO WIN!

SARC MEMBERS AND THEIR FAMILIES ARE NOT ELIGIBLE FOR PRIZES LISTED IN THIS ADVERTISEMENT

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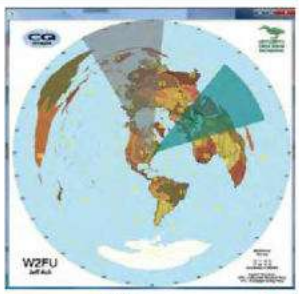

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- Options: outdoor enclosures and external antennas

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QST 2/2020

MFJ...the World Leader in Ham Radio Accessories!

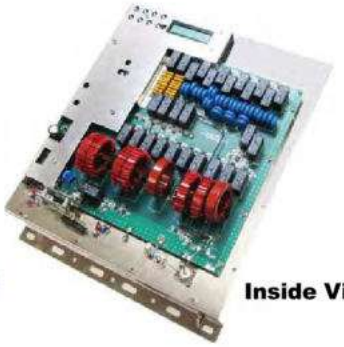
MFJ 1500 Watt Remote Auto Tuner

Place this MFJ-998RT remote tuner at your antenna to match high SWR antennas/long coaxes -- greatly reduce losses for high efficiency

. . . Match 12-1600 Ohms, 1.5 kW, SSB/CW, 1.8-30 MHz . . . Match coax/wire antennas . . . Weather-sealed . . . Remotely powered thru coax . . . Amplifier, radio, tuner protection . . . Output static/lightning protection . . . StickyTune™ always tunes when power folds back . . . DC power jack . . .

MFJ-998RT
$869.95

Bottom Chassis



Inside View

Tune your antenna at your antenna

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and prevent tuning caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive StickyTune™ always tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has ceramic feed-through insulator for wire antennas. 2 kV Teflon® insulated SO-239 – prevents arcing from high SWR.

High Power, Highly Efficient

A highly efficient L-network matches 6-1600 Ohms at full 1500 Watts legal limit SSB/CW 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ InstantRecall™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ Intelli-Tune™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ AdaptiveSearch™ searches only the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional **MFJ-1316, $29.95**. Weighs 9.5 lbs. $13\frac{1}{4}$W x $6\frac{3}{4}$H x $17\frac{1}{2}$D inches.

600W Remote IntelliTuner™

MFJ-994BRT – perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for outdoor use. Remotely powered through coax. Tough, durable, built-to-last cabinet, $9\frac{1}{4}$W x 3H x $14\frac{1}{4}$D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

MFJ-994BRT
$459.95

300W Remote IntelliTuner™

MFJ-993BRT handles 300 Watts SSB/CW and matches an extra-wide 6-1600 Ohm impedances. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for remote outdoor or marine use. Remotely powered through coax. Tough, durable, built-to-last cabinet measures $9\frac{1}{4}$W x 3H x $14\frac{1}{4}$D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

MFJ-993BRT
$339.95

200W Remote IntelliTuner™

MFJ-926B, 200 Watts SSB/CW, matches 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

MFJ-926B $329.95

MFJ No Matter What™ Warranty

One year **No Matter What**™ Warranty
30 Day Money Back Guarentee
(less s/h) on orders direct from MFJ.

160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide range MFJ automatic tuners at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you simply put it up! Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $44.95**. All band ground radial system.

MFJ-2990
$399.95

MFJ Enterprises, Inc. 300 Industrial Pk Rd, Starkville, MS 39759
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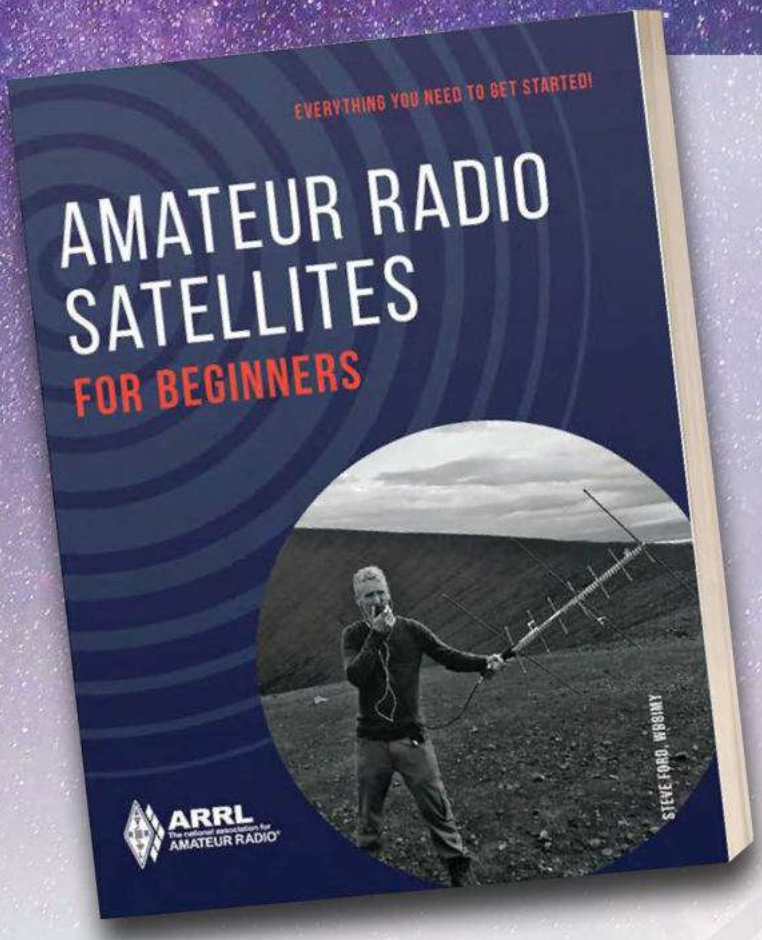
OUTER SPACE IS YOUR NEXT RADIO FRONTIER!

NEW Amateur Radio Satellites for Beginners

"Even with just a dual-band FM transceiver and a mobile antenna, you can make contacts through an amateur satellite!" - Author and *QST* Editor Steve Ford, WB8IMY



You can make contacts through amateur radio satellites, and even with the International Space Station, using equipment you probably own right now!

There are dozens of spacecraft in orbit just waiting for your signals, and more are being launched every year. This book is your guide to a whole new world of operating enjoyment.

Inside you will:

- Be able to locate satellites and determine when they will be available.
- Gain tips for building your own "satellite station".
- Find a simple step-by-step guide to making your first contacts.
- Discover satellite antenna projects you can build at home.

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Check out the new ARRL science and technology podcast. Produced every two weeks, the ***Eclectic Tech*** is hosted by author Steve Ford.

MFJ Tuners

Ham Radio's Most Popular 300 Watt Antenna Tuner

More hams use MFJ-949s than any other antenna tuner in the world!

Why? Because the world's leading tuner has earned a worldwide reputation for being able to match just about anything.

Full 1.8-30 MHz Operation

Tune your antenna for minimum SWR! Works 1.8-30 MHz on dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas...Use coax, random wire, balanced lines. Has heavy-duty 4:1 balun for balanced lines.

Custom inductor switch

Custom designed inductor switch, 1000 volt tuning capacitors, Teflon® insulating washers and proper L/C ratio gives you arc-free

no worries operation up to 300 Watts PEP transceiver input power.

The MFJ-949E inductor switch was custom designed to withstand the extremely high RF voltages and currents that are developed in your tuner.

8-Position Antenna switch

Antenna switch lets you select two coax fed antennas, random wire/balanced line or dummy load through your MFJ-949E or direct to your transceiver.

Lighted Cross-Needle Meter

Full size 3-inch lighted Cross-Needle Meter. Lets you easily read SWR, peak or average forward and reflected power simultaneously. Has 300 Watt or 30 Watt ranges.

QRM-Free PreTune™

MFJ's QRM-Free PreTune™ lets you pre-tune your MFJ-949E off-the-air into its built-in dummy load! Makes tuning your actual antenna faster and easier.

MFJ-949E $219.95

Plus Much More!

Full size built-in non-inductive 50 Ohm dummy load, scratch-proof Lexan multi-colored front panel, $10^5/_8$ x $3^1/_2$ x 7 inches. Superior cabinet construction and more!

MFJ-948, $189.95. Econo version MFJ-949E. Has all features except for dummy load.

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year **No Matter What™** limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-989D Legal Limit Tuner

MFJ-989D $469.95

New, improved MFJ- 989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. Easily handles full 1500 Watts SSB/CW, 1.8-30 MHz, including MARS/WARC bands. Six position antenna switch, dummy load. New 500 pF air variable capacitors. New improved AirCore™ Roller Inductor. New high voltage current balun. New crank knob. $12^7/_8$W x 6H x $11^5/_8$D inches.

MFJ-986 Two knob Differential-T™

MFJ-986 $419.95

Two knob tuning (differential capacitor and AirCore™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 KW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross- Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. $10^3/_4$W x $4^1/_2$H x 15 in.

MFJ-962D Compact kW Tuner

MFJ-962D $359.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 KW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! AirCore™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^3/_4$ x $4^1/_2$ x $10^7/_8$ in.

MFJ-969 300W Roller Inductor Tuner

Superb, AirCore™ Roller Inductor tuning. Covers 6 Meters thru 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross-Needle SWR Wattmeter, QRM-Free PreTune™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^1/_2$W x $3^1/_2$H x $9^1/_2$D inches.

MFJ-969 $259.95

MFJ-941E Super Value Tuner

Most for your money! 300 Watts PEP, 1.8-30 MHZ, lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. $10^1/_2$W x $2^1/_2$H x 7D in. **MFJ-941EK, $149.95.** Tuner Kit -- Build your own!

MFJ-941E $169.95

MFJ-945E HF/6M Mobile Tuner

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8 x 2 x 6 in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. **MFJ-20, $9.95**, mobile mount.

MFJ-945E $159.95

MFJ-971 Portable/QRP Tuner

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny 6 x $6^1/_2$ x $2^1/_2$ in.

MFJ-971 $149.95

MFJ-901B Smallest Versa Tuner

MFJ's smallest (5 x 2 x 6 in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-901B $119.95

MFJ-902B Tiny Travel Tuner

Tiny $4^1/_2$ x $2^1/_4$ x 3 inches, full 150 Watts, 80-6 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, $169.95**. Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^1/_4$ x $2^1/_4$ x $2^3/_4$ inches.

MFJ-902B $129.95

MFJ-16010 Random Wire Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 2 x 3 x 4 in.

MFJ-16010 $79.95

MFJ-9201 QRPocket™ Tuner

80-10 Meters, 25 Watts. 12 position inductor, tune/bypass switch, wide-range T-network, BNCs. 4W x $2^5/_8$H x $1^1/_2$D inches. **MFJ-9201, $59.95**

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MFJ-921/924 VHF/UHF Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8 x $2^1/_2$ x 3 in.

MFJ-921/924 $109.95

MFJ-931 Artificial RF Ground

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $249.95**, Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 $129.95

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BNC for transmitter, wing nut posts for loop wire. Tiny 2¼Wx4Hx2¼D inches.

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VIDEOS: https://m.youtube.com/results?search_query=MFJ-9232

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MFJ-1899T, $99.95. Perfect for QRP radios like FT-817, KX3, Xiegu, others. Covers *all* bands 80-6 Meters including WARC. Ten section telescoping whip (52" extended, 7" collapsed). 12" base loading coil with *Wander Lead*. Whip/coil unscrews for easy storage. 25Watts. BNC.

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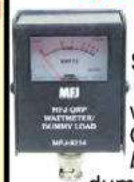

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The ARRL Maxim Society was created to recognize individuals and organizations who have contributed to ARRL over the years and achieved a lifetime contribution level of $10,000 or more. These generous donors have provided important resources to support the Diamond Club, the Spectrum Defense Fund, the Education & Technology Program, the Legislative Issues Advocacy Fund, the Second Century Campaign, and more.

Since The Maxim Society's inception in 2002, ARRL has welcomed 287 members into this special group.

To learn more, please visit **www.arrl.org/maxim-society** or contact Melissa Stemmer, KA7CLO, Development Manager, at **860-594-0348** or **mstemmer@arrl.org**.

Photo taken at the 19th Annual ARRL Donor Recognition Reception, held May 16, 2019 at The Schuster Center Wintergarden in Dayton Ohio.

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