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JANUARY 2020

75 ANNIVERSARY

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ANNOUNCEMENTS

JANUARY 2020

WORLDWIDE — To celebrate its 10th anniversary, the **CW Operators' Club** will hold a month-long on air event in January beginning 0000 UTC January 1 through 2359 UTC January 31 urging all hams to make CW contacts with members to accumulate points. Amateurs will be active on all bands so work as many members and club calls as possible. Logs should be emailed to <anniversarylogs@cwops.org>. Website: <http://cwops.org>.

WAUKESHA, WISCONSIN — The West Allis Radio Amateur Club will hold the **48th Annual Midwinter Swapfest** from 8 a.m. to 1 p.m., Saturday, January 4 at the Waukesha County Expo Arena, 1000 Northview Road (County Trunk FT). Contact: Erwin, WI9EV, (262) 271-0630. Email: <wi9ev@wi.rr.com>. Website: <www.warac.org>.

LOCUST FORK, ALABAMA — The Blount County Amateur Radio Club will hold **Freezefest 2020** from 8 a.m. to noon, Saturday, January 4 at Locust Fork High School, 155 School Road. Contact: Dr. David Skees, KG4HVQ, <info@w4blt.org>. Website: <http://freezefest.w4blt.org>. Talk-in 146.700- (PL 91.5). VE exams.

WHITE PINE, TENNESSEE — The Lakeway Amateur Radio Club will hold the **28th Annual Mossistown Hamfest** from 8 a.m. to 3 p.m., Saturday, January 4 at the Walters State Expo Center, 1615 Pavilion Drive. Email: <lakewayarcboard@gmail.com>. Website: <www.morristownhamfest.com>. VE exams.

SCHERTZ, TEXAS — The San Antonio Radio Club will hold the **Radio Fiesta 2020** from 1-5 p.m., Friday, January 10 and from 8 a.m. to 2 p.m., Saturday, January 11 at the Schertz Civic Center, 1400 Schertz Parkway. Email: <radiofiesta@w5sc.org>. Website: <http://w5sc.org>. VE exams, DXCC / WAS card checking.

FOREST HILL, TEXAS — The Cowtown Amateur Radio Club will hold the **2020 Cowtown Hamfest** and **2020 ARRL North Texas Section Convention** from 3-7 p.m., Friday, January 17 and from 7 a.m. to 3 p.m., Saturday, January 18 at the Forest Hill Civic & Convention Center, 6901 Wichita Street. Phone: (817) 731-6347. Email: <kc5uyr@compuserve.com>. Website: <www.cowtownhamfest.com>. Talk-in 146.94 (PL 110.9). VE & GROL exams.

HAMMOND, LOUISIANA — The Southeast Louisiana Amateur Radio Club will hold the **39th Annual Hammond Hamfest** from 8 a.m. to 2 p.m., Saturday, January 18 at the Pennington Student Activity Center, 1350 North General Pershing Street. Contact: Tyrone Burns, N5XES, <n5xes@arrl.net>. Website: <www.selarc.org>. Talk-in 147.000- (PL 107.2), 145.130- (PL 107.2), or 444.250+ (PL 107.2). VE exams.

LOVELAND, COLORADO — The Northern Colorado Amateur Radio Club will hold the **Winter 2020 Hamfest** from 8 a.m. to 1 p.m., Saturday, January 18 at the Thomas McKee 4-H Building, Larimer County Fairgrounds, 5280 Arena Circle. Contact: Joe Hawley, KDØTYU, (970) 689-0828. Email: <president@ncarc.net>. Website: <www.ncarrc.net>. Talk-in 448.025- (PL 100). VE exams.

QUARTZSITE, ARIZONA — Quartzfest 2020 will be held from Sunday, January 19 through Saturday, January 25 at Bureau of Land Management property located at La Paz Road and U.S. 95. Contact: Kris, KR1SS, <kristynweed@gmail.com>. Website: <www.quatzfest.org>. VE exams, T-Hunt, antenna shootout, 4x4 off road trip, prospecting, campfires, night-time movies, Pot Luck dinner, hootenanny, and lots more.

ST. CHARLES, ILLINOIS — The Wheaton Community Radio Amateurs will hold its **53rd Annual Mid-Winter Hamfest & Electronics Hobby Expo** from 8 a.m. to 1 p.m., Sunday, January 19 at the Kane County Fairgrounds Expo Center, 525 S. Randall Road. Phone: (630) 923-5447. Email: <info@w9ccu.org>. Website: <www.w9ccu.org>. Talk-in 145.31- (PL 107.2). VE exams.

COLLINSVILLE, ILLINOIS — The St. Louis and Suburban Radio Club will hold **Winterfest** and the **2020 ARRL Midwest Division Conference** from 5-10 p.m., Friday, January 25 and from 8 a.m. to 4 p.m., Saturday, January 25 at the Gateway Center, 1 Gateway Drive. Email: <winterfest@slsrc.org>. Website: <http://winterfest.slsrc.org>. VE exams, DXCC card checking.

STRASBURG, OHIO — The Tusco Amateur Radio Club will hold its **30th Annual Hamfest, Electronics, and Computer Show** from 8 a.m. to 1 p.m., Sunday, January 26 at 965 N. Wooster Avenue. Contact: Janice Green, KB8YDK, (330) 340-4424. Email: <k8wfn@tusco.net>. Website: <www.tuscoarc.org>. Talk-in 146.730.

FEBRUARY 2020

WORLDWIDE — The Fourth Annual AM Rally will kick off 0000 UTC, Saturday, February 1 and run through 0700 UTC, Monday, February 3 to encourage use of the AM mode. Activity will be on the 160-, 80-, 40-, 20-, 15-, 10-, and 6-meter bands and you must use AM. For more information, contact Clark, N1BCG, <n1bcg@internetwork.com>. Website: <www.amrally.com>.

ORLANDO, FLORIDA — The Orlando Amateur Radio Club will hold the **2020 Orlando Hamcation** and **2020 ARRL Northern Florida Section Convention** from 9 a.m. to 5 p.m., Friday, February 7; 9 a.m. to 5 p.m., Saturday, February 8; and 9 a.m. to 2 p.m., Sunday, February 9 at the Central Florida Fairgrounds & Expo Park, 4603 West Colonial Drive. Phone: (407) 841-0874 or (800) 214-7541. Email: <info@hamcation.com>. Website: <www.hamcation.com>. Talk-in 146.760- (PL 103.5) or 443.050+ (PL 103.5). VE exams, special event station K1AA.

YUMA, ARIZONA — The Amateur Radio Council of Arizona will hold the **Yuma Hamfest** and **2020 Southwestern Division Convention** from noon to 5 p.m., Friday, February 14 and from 8 a.m. to 5 p.m., Saturday, February 15 at the Yuma County Fairgrounds, 2520 East 32nd Street. Email: <info@yumahamfest.org>. Website: <www.yumahamfest.org>. VE exams, DXCC card checking, T-hunt, and balloon launch.

RICKREALL, OREGON — The Salem Repeater Association will hold the **40th Annual Salem Hamfair** from 9 a.m. to 3 p.m., Saturday, February 15 at the Polk County Fairgrounds, 520 S. Pacific Highway West. Contact: Chris Portal, W7CLP, (503) 779-6998. Email: <hamfair@w7sra.org>. Website: <www.w7sra.org>. Talk-in 145.33- (PL 186.2).

ST. CLOUD, MINNESOTA — The Saint Cloud Amateur Radio Club will hold its **Cabin Fever Reliever Hamfest** beginning 9 a.m., Saturday, February 15 at the Eagles Aerie 622, 730 41st Avenue North. Website: <http://w0sv.club/hamfest>. Talk-in 147.015+ (PL 100). VE exams, DXCC / VUCC / WAC / WAS / CQ WAZ card checking.

LA PORTE, INDIANA — The La Porte County Amateur Radio Club will hold the **Cabin Fever Hamfest 2020** from 7 a.m. to 1 p.m., Saturday, February 22 at the La Porte Civic Auditorium, 1001 Ridge Street. Phone: (219) 851-2133. Email: <cabinfeverhamfest@gmail.com>. Website: <http://lpcarc.org/hamfest>. Talk-in 146.61 (PL 131.8). VE exams.

LIVONIA, MICHIGAN — The Livonia Amateur Radio Club will hold the **50th Annual Swap-N-Shop** from 8 a.m. to noon, Sunday, February 23 at the Managhan Banquet Hall-Knights of Columbus, 19801 Farmington Road. Phone: (734) 941-5043. Email: <k8uns@arrl.net>. Website: <www.livoniaarc.com>. Talk-in 145.35 (PL 100).

MARCH 2020

ELYRIA, OHIO — The Northern Ohio Amateur Radio Society will hold the **NOARS Winter Hamfest** from 8 a.m. to noon, Sunday, March 1 at the Lorain County Community College-John A. Spitzer Conference Center, 1005 N. Abbe Road. Contact: Carl Rimmer, W8KRF, (216) 256-9624 (before 9 p.m.). Email: <winterhamfest@noars.net>. Website: <www.noars.net/winterhamfest>. Talk-in 146.70- (PL 110.96).

CAVE CITY, KENTUCKY — The Mammoth Cave Amateur Radio Club will hold the **44th Annual Cave City Hamfest** beginning 7:30 a.m., Saturday, March 7 at the Cave City Convention Center, 502 Mammoth Cave Street. Contact: Larry Brumett, KN4IV, (270) 651-2363. Email: <lbrumett@glasgow-ky.com>. Talk-in 146.34+ (PL 114.8). VE exams.

IRVING, TEXAS — The Irving Amateur Radio Club will hold its **Hamfest** from 8 a.m. to 1 p.m., Saturday, March 7 at the Betcha Bingo Hall, 2420 Irving Boulevard. Contact: Ken Hansen, N2VIP, <ken@n2vip.org>. Website: <http://irvingarc.org>. Talk-in 146.720- (PL 110.9). VE exams.

PUYALLUP, WASHINGTON — The Mike & Key Amateur Radio Club will hold the **39th Annual Mike and Key ARC Electronics Show & Swap Meet** beginning 9 a.m., Saturday, March 7 at the Pavilion Exhibition Hall-Puyallup Fair & Events Center, 110 9th Avenue SW. Phone: (253) 631-3756. Email: <ddmdink@gmail.com> or <n7wa@arrl.net>. Talk-in 146.82- (PL 103.5). VE exams.

CHARLOTTE, NORTH CAROLINA — The Mecklenburg Amateur Radio Society will hold the **2020 Charlotte Hamfest** from 3-7 p.m., Friday, March 13 and from 8:30 a.m. to 4 p.m., Saturday, March 14 at the Cabarrus Arena & Events Center, 4551 Old Airport Road. Phone: (704) 948-7373. Website: <http://charlottehamfest.org>. Talk-in 146.655 or 146.940 (PL 118.8). VE exams, card checking.

CHARLESTON, WEST VIRGINIA — The 36th Annual Charleston Area Hamfest and **2020 ARRL WV Section Convention** will be held from 9 a.m. to 2 p.m., Saturday, March 14 at the Charleston Coliseum & Convention Center, 200 Civic Center Drive. Contact: Russ Dean, KE8DMB, (304) 988-1373. Email: <ke8dmb@gmail.com>. Website: <http://chaswvhamfest.com>. VE exams, DXCC / CQDX / WAS / VUCC card checking.

BOONVILLE, MISSOURI — The Boonville Amateur Radio Club will hold its **Hamfest** from 9 a.m. to 3 p.m., Saturday, March 21 at the Cooper County Youth Fairgrounds, 16899 Dunkles Drive. Contact: Dwight (660) 621-1265, Tom (660) 841-5287, or Bob (660) 537-4211. Email: <wa0e@arrl.net>. Website: <http://w0brc.org>. Talk-in 147.360+ (PL 127.3).

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HAM RADIO NEWS

Hams Lose Special Exemptions on RF Exposure Rules

The first major revision of the FCC's RF exposure rules in more than 20 years will result in changes in the way that hams must apply the rules. The *ARRL Letter* reports that the basic limits remain unchanged, but that amateurs will now be subject to the same standards for evaluating RF exposure as other FCC licensees. The current rules provide a framework specific to amateurs that exempts certain transmitters from the need to conduct evaluations based on their power and operating frequencies [see Section 97.13(c)(1) of the rules]. The new rules will replace that framework with a general statement that "amateur licensees may evaluate their operation with respect to members of his or her immediate family using the occupational / controlled exposure limits" already in the rules while potential RF exposure to other people "must be evaluated with respect to the general population / uncontrolled exposure limits." The practical impact on most amateurs, according to the FCC, will be negligible, noting that a transmitter that had been categorically excluded from evaluation in the past most likely will remain exempt. The ARRL is asking the FCC to provide an online calculator with which to make determinations about RF exposure measurements.

ARRL Executive Committee Meets With FCC

ARRL President Rick Roderick, K5UR; Washington Counsel Dave Siddall, K3ZJ; and several members of the League's Executive Committee met with various FCC officials in Washington in early November. According to the *ARRL Letter,* topics discussed included the RF exposure rule changes described above, the digital data symbol rate proceeding, expansion of the 60-meter band in accordance with international provisions adopted at the 2015 World Radiocommunication Conference, and the ongoing problem of insufficient enforcement in the amateur bands and the startup of the ARRL's new Volunteer Monitor program.

ARRL Committee Drafting New Antenna Bill

Members of the ARRL board of directors' Legislative Advocacy Committee are working on the wording of a new bill to give amateurs greater antenna rights in communities subject to private land-use restrictions. This would be the successor to the Amateur Radio Parity Act, which did not see final action in Congress amid complaints from many hams that it offered too little protection and might actually make some antenna installations more difficult than they already are. The *ARRL Letter* reports that committee members have met several times with members of Congress and their staffs as they work on drafting the new bill.

ARRL and AMSAT to Oppose 3.3-GHz Proposal

The FCC adopted a Notice of Proposed Rulemaking at its December 12th meeting to provide more spectrum for wireless broadband by removing non-federal users from the 3.1- to 3.55-GHz band. This includes the 9-centimeter amateur band at 3.3-3.5 GHz (allocated to hams on a secondary basis).

In a separate proceeding, the *ARRL Letter* reports, the Commission also decided to "take a fresh and comprehensive look" at current allocations in the 5.9-GHz band, including a secondary amateur allocation at 5650-5925 MHz. Both the ARRL and AMSAT say they will file comments in opposition to removing any amateur allocations in these bands.

WRC-19: Hams Gain Worldwide Allocation at 6 Meters; New Threat to 10 GHz

The 2019 World Radiocommunication Conference (WRC-19) in Sharm El-Sheik, Egypt, has concluded with a win for hams who enjoy six meters.

Key achievements overall, according to top International Telecommunication Union (ITU) officials at a wrapup news conference, included identifying new orbital slots for broadcast satellites; setting new rules for non-geostationary satellites, with a focus on "mega-constellations" of small interconnected satellites to provide 5G broadband coverage worldwide; rules for Earth stations in motion to provide greater connectivity for people aboard planes, ships, and trains; global harmonization of millimeter bands for 5G while protecting incumbent services; and identifying frequency bands for HAPS (High Altitude Platform Services), which would provide internet access to remote locations via floating platforms roughly 30 miles above the Earth's surface.

The major interest for hams was a proposal to provide worldwide harmonization of amateur allocations at 6 meters, which is not currently designated as an amateur band in ITU Region 1 (Europe, the Middle East and Africa).

Responding to a question from *CQ*, ITU Terrestrial Services Chief Nikolai Vassiliev reported that the conference had reached final agreement on a worldwide 50-MHz allocation, noting that "this is a very interesting band" capable of supporting communications over several thousand kilometers when conditions are right.

In addition, ITU Space Services Chief Alexandre Vallet assured *CQ* that the new rules on non-geostationary satellites will apply only to commercial satellites and will have no impact on the Amateur Satellite Service.

However, a new threat emerged at the conference as the delegates agreed on agenda items to work on for the next WRC, in 2023. Among those items is a proposal to study the possible use of several microwave bands for future cellphone use, including 10-10.5 GHz, the 3-centimeter amateur band. The "VHF-Plus" column in the February issue of *CQ* will discuss these issues affecting amateur microwave bands in more detail.

ARRL Calls on FCC to Dismiss NYU Petition on Encoded Messages

The ARRL says a petition for declaratory ruling about encoded messages on the ham bands should be dismissed. As we reported last month, New York University asked the FCC to issue a declaratory ruling clarifying that its rule prohibiting hams from transmitting "messages in codes or ciphers intended to obscure the meaning thereof" also applies to "effectively encrypted or encoded messages" that "cannot be readily decoded over the air for true meaning." The focus of the petition is Winlink, along with PACTOR and similar modes, in which transmissions can only be decoded by a single linked station. NYU says this makes it difficult for amateurs to self-police.

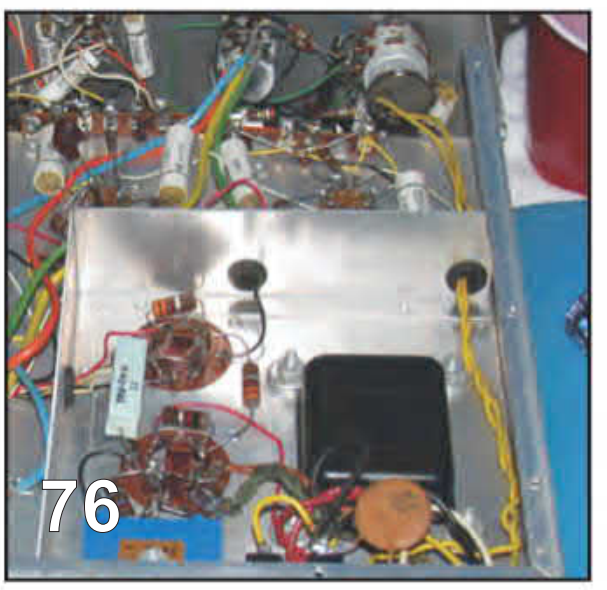
The ARRL response, according to the *ARRL Letter*, is that the requested ruling would make clear language vague and could actually weaken the current prohibition on "messages encoded for the purpose of obscuring their meaning." The League pointed out that Morse code transmissions are "effectively encoded" even though there is no intent to obscure the meaning of the message, and argues that adopting the proposed changes would hobble "vibrant experimentation with digital techniques."

CONTENTS

JANUARY 2020 • VOLUME 76 NUMBER 1

COVER: CQ's 75th Anniversary Edition

Join CQ for a trip 75 years in the making as we recall the radical advancements in technology since World War II to the present-day wonders that currently comprise our ham shacks. Also we look toward the next 75 years as the youth of today remake ham radio using the same spirit of innovation and exuberance that drove a young Marconi to imagine a world without wires at the turn of the last century. Here's to CQ for 75 great years and here's to our readers for 75 more great years enjoying the finest hobby in the world!



FEATURES

75-YEAR ANNIVERSARY SPECIAL: Come along as CQ journeys through 75 years of ham radio seen through the eyes of the people that chronicled it. Start with Editor Rich Moseson's sprawling feature on 75 years of the people and events that shaped CQ on page 22. Look for historic recreation of classic CQ articles on pages 31, 36, and 44, while our present-day columnists reminisce on pages: 64, 70, 72, 74, and 76.

COLUMNS

DEPARTMENTS

NEWS BYTES

2020 Carole Perry Educator of the Year Melissa Pore, KM4CZN. (Photo via QRZ.com)

West Point cadets at the 2019 Radio Club of America Technical Symposium and Banquet. From left, Cadet Nolan Pearce, KE8JCT; RCA Director and Youth Activities Chair Carole Perry, WB2MGP; and Cadet Patrick McGurrin, KD2SUE. (Photo courtesy of RCA)

2013 Newsline Young Ham of the Year Padraig Lysandrou, KC9UUS, now a Ph.D. student at Cornell University, receives the second-place award at the RCA banquet for his presentation at the technical symposium on new developments in the space industry. (Photo courtesy of RCA)

Melissa Pore, KM4CZN, Named 2020 Educator of the Year

Melissa Pore, KM4CZN, has been selected as the Orlando Hamcation's Carole Perry Educator of the Year for 2020. The award honors both professional and non-professional educators for outstanding contributions toward educating and advancing youth in amateur radio. Pore is a high school teacher in Virginia who is also heavily involved in the Amateur Radio on the International Space Station (ARISS) program.

Pore teaches engineering and technology at Bishop O'Connell High School in Arlington, Virginia, and is involved with the school's amateur radio and engineering clubs. She also led the effort that resulted in the launch of STMSat-1, the first satellite ever built by elementary school students. Pore has made presentations, often with her students, at various conferences of space educators and is a member of the ARISS U.S. Education Team that evaluates applications for school contacts via amateur radio with astronauts aboard the International Space Station.

The Carole Perry Educator of the Year Award is sponsored by the Orlando Amateur Radio Club, and is named in honor of legendary ham educator Carole Perry. WB2MGP. Pore will receive her award at the Orlando HamCation in February.

West Point Cadets at RCA Symposium/Banquet

Speaking of Carole Perry, she provided us with the following info and photos in her hat as the Radio Club of America's Youth Activities Chair. This is a follow-up of sorts to December's "News Bytes" item about West Point cadets contacting astronaut and West Point alumnus Col. Drew Morgan, KI5AAA, aboard the International Space Station.

Recently, I was contacted by two freshman West Point cadets who were interested in attending our RCA Awards Banquet and Technical Symposium in November. Cadet Patrick McGurrin, KD2SUE, has an uncle, Lou Fiore, W2LTF, who was being elevated to Fellow at the RCA Banquet that weekend. He was intrigued by what his uncle relayed about the topics that would be discussed at our Technical Symposium. Many of the speakers were giving presentations about new technologies and initiatives in the space and wireless industries.

Since Patrick and fellow cadet and West Point Amateur Radio Club member Nolan Pearce, KE8JCT, were interested in space engineering and technology, they thought they could gain a lot by attending the symposium. Pearce had recently been one of two cadets using club station W2GKY to make an ARISS contact with the International Space Station. Together, we worked out the logistics; and thanks to the generosity and welcoming attitude of several RCA officers, directors and club members, the cadets were sponsored to attend both events at no cost to them and to join us for an amazing weekend of networking opportunities.

Special thanks to RCA Director Ray Novak, N9JA, ICOM Senior Sales Manager, who donated an IC-7610 radio for the silent auction to help sponsor the two cadets and to support our RCA Youth Activities program. As luck would have it, the radio was won by Michael Kalter, W8CI, Dayton Amateur Radio Association Treasurer and major supporter of my Hamvention® Youth Forum. Michael graciously invited the two cadets to join us at Hamvention in 2020. I am hoping they will say a few words at my Youth Forum there as well.

It was a great honor for us to host these two very impressive young men, and we are excited about having them as RCA members. There are already plans to contact Club Officer in Charge Col. Stephen Hamilton, KJ5HY, to see if any RCA members can be of assistance to W2GKY in donating equipment or supplies for their radio station. We look forward to a terrific relationship with our two new members and the amateur radio club at the United States Military Academy. – *WB2MGP*

Updated Forecast for Solar Cycle 25 Predicts Solar Minimum This Spring, Maximum in 2025

An international panel of solar experts has

(Continued on page 9)

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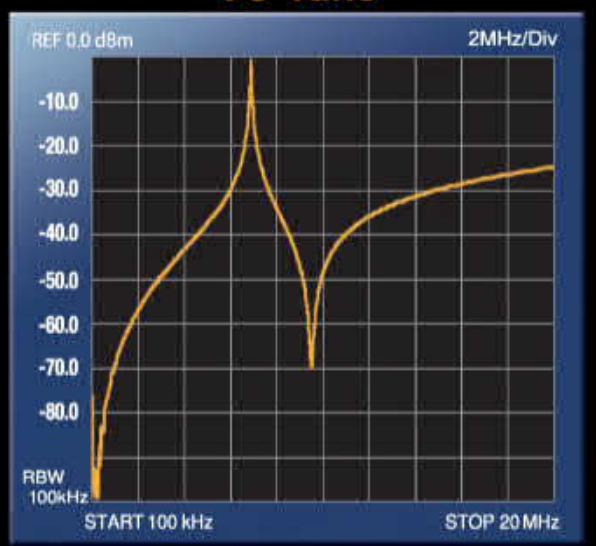
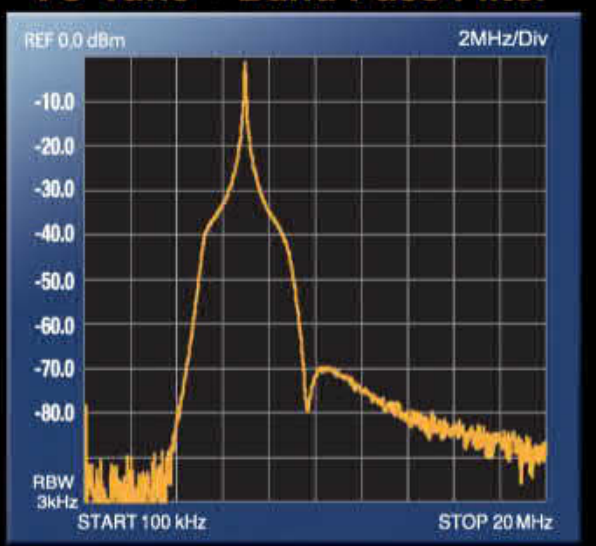


7MHz, Span 20MHz

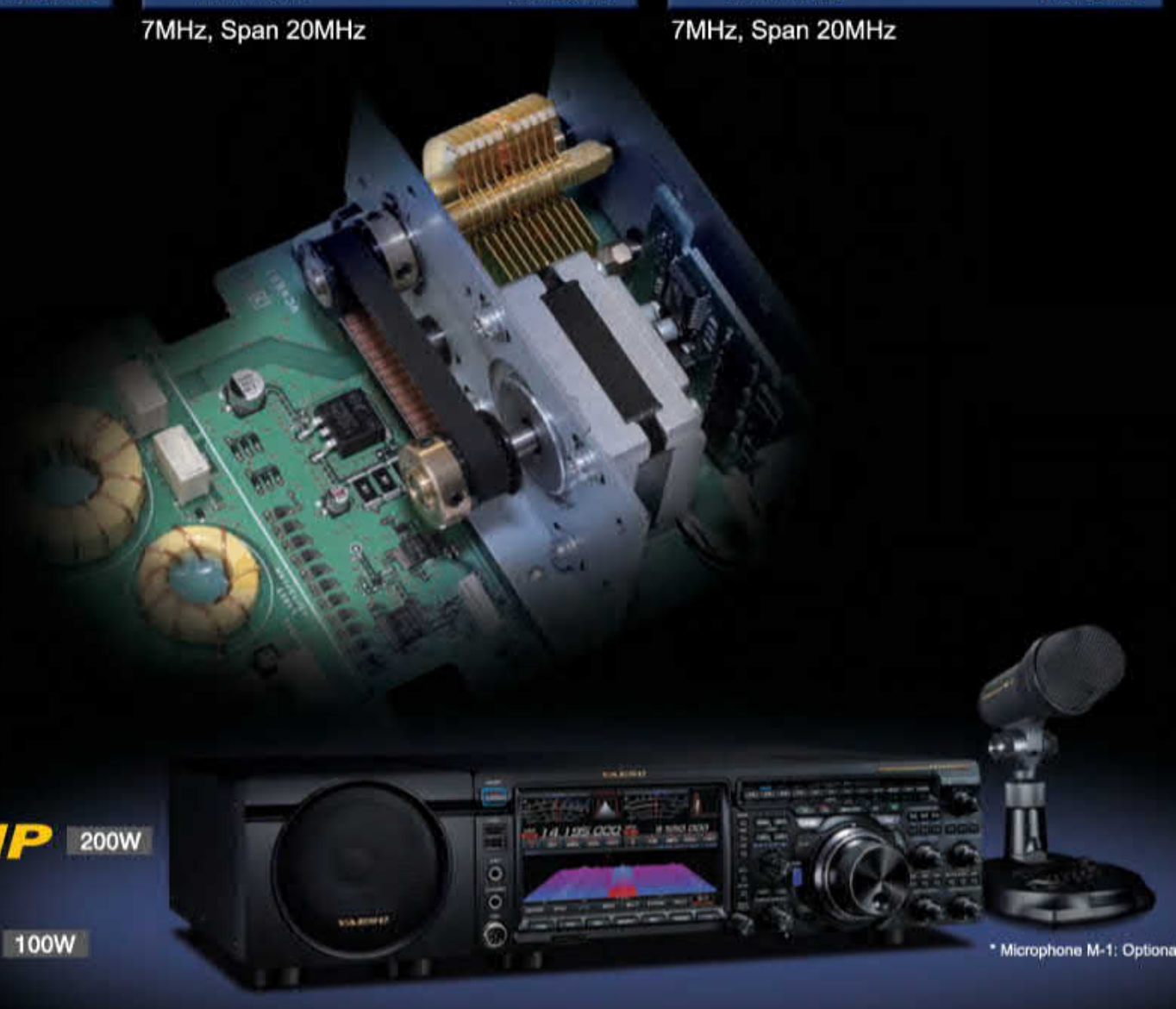
Band Pass Filter

7MHz, Span 20MHz

VC-Tune + Band Pass Filter



7MHz, Span 20MHz



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ZERO BIAS: A CQ Editorial

BY RICH MOSESON,* W2VU

Numbers (Starting With 75)

Ham radio is a hobby dominated by numbers ... the bands on which we're allowed to operate, whether described in terms of frequency or wavelength; how many watts of power our transmitters are sending to our antennas, how many elements our antennas have and how many feet (or meters) above the ground they are; how many countries, zones or prefixes we've contacted; how many miles per watt our signals have traveled; how many points we made in the last contest; component values in our latest project, or how many words a minute we can copy in Morse code. The list goes on and on.

There are three numbers bouncing around my head at the moment: 75, 900, and 240. This is *CQ*'s 75th anniversary issue. Over those 75 years of publication, there have been 900 issues of this magazine, and an equal number of editorials, of which I have now written approximately 240, or just over 25%. Some come easily, others are a struggle. In those latter cases, the problem is generally resolved by spending a couple of hours on the radio.

I was reminded of that just a few nights ago, when I was working on something in my shack and had my 2-meter FM rig on in the background, scanning for activity on local repeaters. It stopped on 146.55 simplex, with a very loud signal coming through the speaker. Obviously, it was someone nearby, but I didn't recognize his voice or callsign, and I could only hear his half of the conversation. After a while, when I'd finished doing whatever I was doing, I broke in to say hi and see just how close a neighbor he was. His signal sounded like he was just a couple of blocks away, but it turned out he was actually a couple of towns away. And while we'd never met before, the ham to whom he was talking (and who I couldn't hear) was an old friend of mine who I hadn't seen or talked with in a couple of years. We each relayed our greetings through our mutual QSO partner, and it occurred to me that ham radio is a very small world … and that even within that small world, we often aren't very far from our many radio friends, even if we can't hear them at the moment.

It also reminded me that, even in a hobby so consumed with numbers, it isn't really about numbers, it's about people. Nearly everything we do in ham radio is in pursuit of connecting with other people, making friends around the world and realizing that those friends are never too far away, even if we can't hear them at the moment.

Nearly everything we do in *CQ*, and everything we've done in these pages for the past 75 years, is in pursuit of making your pursuits more successful, more educational, more exciting, more fun. No agendas, no organizational reports, just practical, informative, interesting articles to help you get the most out of our shared pastime.

Looking back through those 900 issues, there is a remarkable consistency — information on the latest advances in technology and how to put that technology to work in your station; information on operating adventures and expeditions, and how to increase your chances of success in making contact with stations in rare locations; how to build radios and accessories with which to make those contacts, and be able to say, when someone asks about your setup, "I built it myself."

Another consistent theme has been promoting new modes, bands and activities, and welcoming newcomers to the hobby or to sub-hobbies under the ham radio umbrella. From the first Novice column in any ham magazine back in the early 1950s to the only MF/LF Operating column today, *CQ* has always focused on providing practical tips and encouragement for trying something new and celebrating successes. While many of our authors and columnists over the years have been leading experts in their fields, their goal has never been to impress you with how much they know, but rather to share their knowledge in ways that are helpful to the average ham.

We also have a habit of simultaneously looking back into our history and ahead into our future (particularly in January, which is named for Janus, the Roman god of transitions, and is often portrayed with two faces — one looking into the past and one into the future). This is in line with *CQ*'s mission statement, published in our very first issue (and republished in full as part of our history article on page 22 of this issue), *"… we shall follow up tradition (with which every ham must be familiar) with all the vital news of amateur radio today and tomorrow."* This issue continues that tradition, with several articles looking back over the past 75 years, plus an article looking forward to the first **Youth On The Air (YOTA) camp** to be held in the Americas later this year, and how you can help assure its success (see page 10).

My first direct involvement with *CQ* magazine itself, even after working here for several years on producing videos and getting us onto the internet, was 25 years ago, as *CQ*'s 50th Anniversary Coordinator. Little did I imagine at the time that I would be presiding over the magazine's 75th anniversary a quarter-century later.

I had the opportunity then to talk with some members of *CQ*'s founding generation and recount their first-hand recollections of this magazine's birth and early years. Those reminiscences were shared in our 50th anniversary issue in January 1995, and some are republished in this issue as well. More will follow later this year. Virtually all of the people who oversaw those early years are gone now, so it's great that we have their stories as part of our collective history, not only of *CQ* but of amateur radio itself in the post-World War II era. It is an incredible history, and there is much more yet to be written as a new generation of young hams and emerging leaders make their presence felt.

Happy New Year, Happy Birthday to us, and let's raise an 807 (if you remember either reference, and yet another number[1]) to the next 75 years and beyond!

– 73 (75?), Rich, W2VU

Note:

1. For those of you who *don't* remember, an 807 was a vacuum tube with a plate cap commonly used in power amplifiers (actually still available for tube enthusiasts). Over time, since it was shaped like a bottle with a cap on top, it also came to be used by hams as a reference to a bottle of beer!

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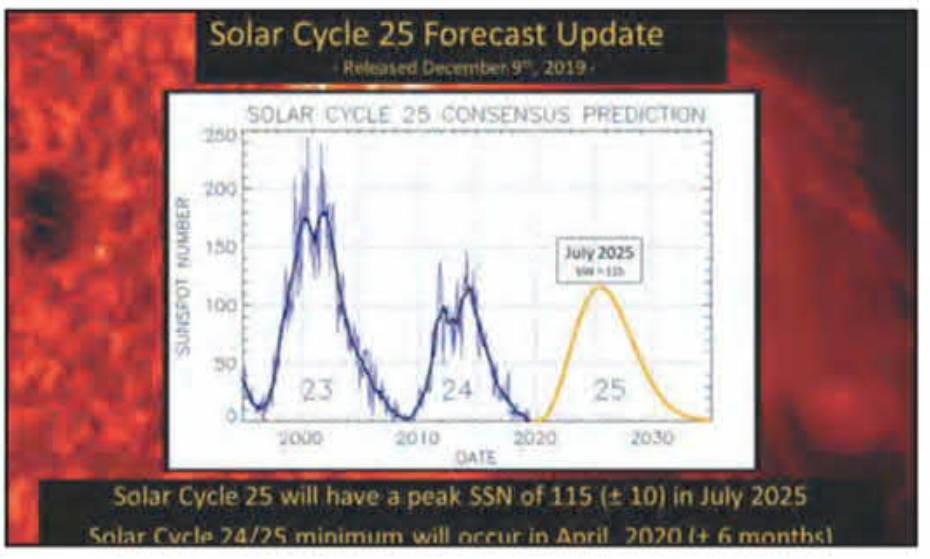
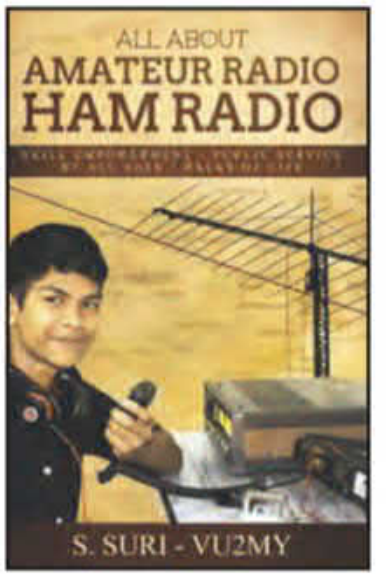


Updated forecast for Solar Cycle 25 (far right) in comparison with Cycles 23 and 24. (NOAA Space Weather Prediction Center image)

released an updated prediction for Cycle 25. The group is chaired by the U.S. National Oceanic and Atmospheric Administration (NOAA) and NASA. The December 9th forecast update continues the previous prediction that Cycle 25 will be of average intensity and similar to currently-ending Cycle 24. A more specific timing prediction forecasts that official solar minimum between Cycles 24 and 25 will come this April (±6 months) and that Cycle 25 will peak in July, 2025 (±8 months) with a maximum smoothed sunspot number of 115. The update notes that, if the April 2020 forecast minimum is correct, Cycle 24 will have lasted 11.4 years and will be the 7th-longest on record.

India's Vice President Introduces New Ham Radio Book

S. Suri, VU2MY, founder and Chairman Emeritus of India's National Institute of Amateur Radio (NIAR), has received some high-powered help in promoting his new introductory book about amateur radio in India, *All About Amateur Radio / Ham Radio*. Suri presented a copy of the book to Indian Vice President Shri. M. Venkaiah Naidu, who promptly put out a tweet with a photo and commented that the book "highlights the importance of ham radio …" Suri added that the vice president spent a considerable amount of time with the group of hams, said he had been aware for several years of NIAR and the good work that it has done. The book may be ordered online from Flipkart at <https://tinyurl.com/qkt3jsp>.



S. Suri, VU2MY's, new book, All About Amateur Radio / Ham Radio in India, got a boost on its release from the country's vice president. (Cover via Flipkart.com)

Photo A. the National Voice of America Museum of Broadcasting in West Chester, Ohio, will host the first-ever Youth on the Air camp in the Americas this coming June. (Photos courtesy West Chester Township, Ohio)

Many of the articles in this 75th anniversary issue reflect on our hobby's history since 1945. This one provides some balance — looking to our future instead of our past — not only in terms of an upcoming event but also our next generation of amateurs.

Youth on the Air Camp Comes to the Americas

BY NEIL RAPP,* WB9VPG

It was recently announced that the first Youth on the Air Camp to be held in the Americas is planned for June 21-26, 2020, at the National Voice of America Museum of Broadcasting in West Chester, Ohio. Attendance will be open to licensed hams between the ages of 15 and 25 living in North, Central, or South America (see News for more details). We asked project director Neil Rapp, WB9VPG, to share with us the story of how it all came together and what the amateur community can do to help support it. –W2VU

Putting together the first camp for young amateur radio operators in the Americas has been no small feat, and the job isn't over yet. Our work began back in March 2019. As I often do before and after hosting my podcast, "Ham Talk Live!", I was talking with one of my guests, Sterling Mann, NØSSC, and we were discussing the Young Amateurs Radio Club Youth Contesting Program,[1] through which young radio operators are matched with nearby contest stations in order to gain some invaluable experience. On a previous episode, Sterling, along with Sam Rose, KC2LRC, had talked about their experiences in Austria while attending the Youngsters on the Air camp in 2016.[2] They made their intent clear: They wanted to bring a similar YOTA program to the Americas. Despite some enthusiasm upon their return, the plans just hadn't worked out yet. So after the show, I asked Sterling, "So, what's the latest on the YOTA Camp?" He informed me that it had stalled once again. There was still

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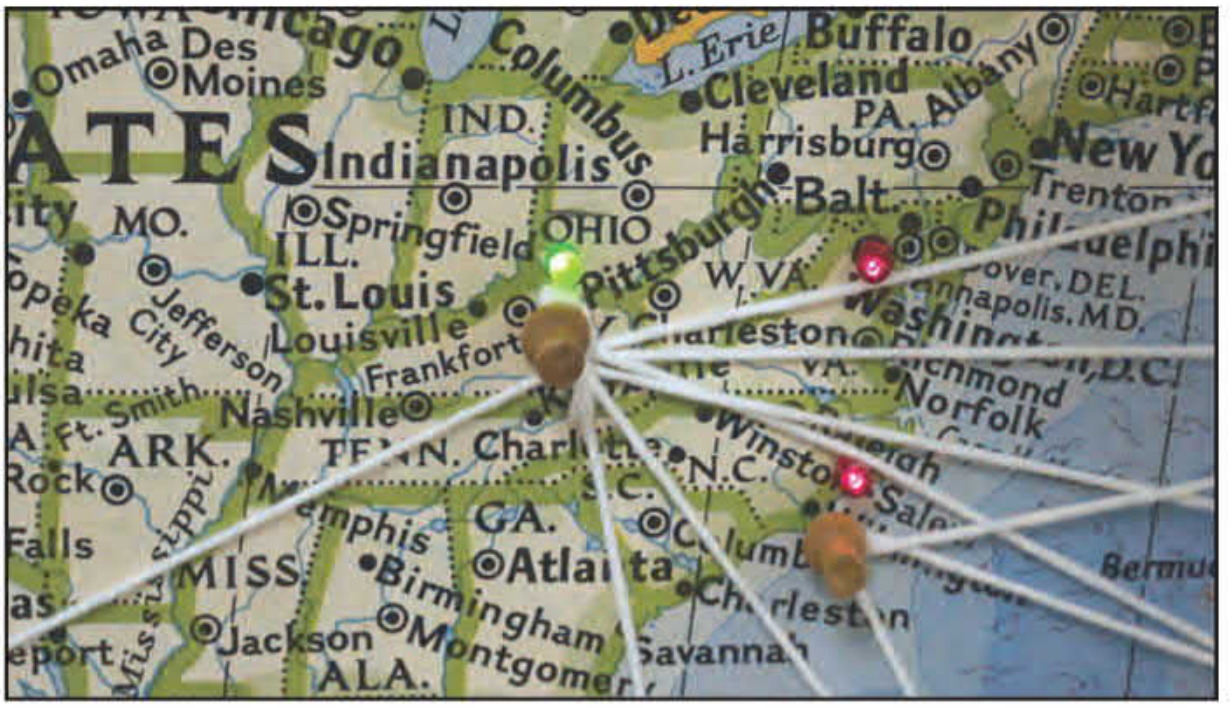

Photo B. Cincinnati, Ohio is centrally located for a large portion of the U.S. population, and has good air travel connections to everywhere else.

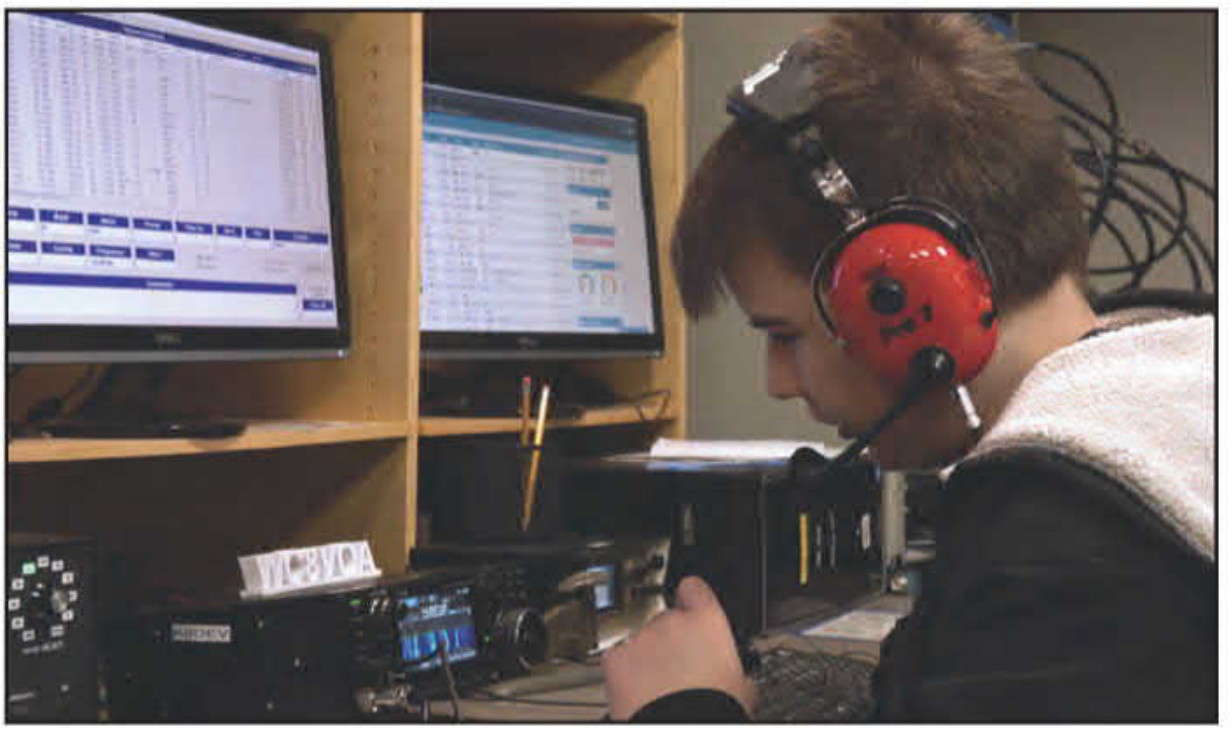

Photo C. Nicolas Brault (not yet licensed) on the air from WC8VOA at the VOA Museum, under the watchful eye of licensed control operators. YOTA Camp participants will be able to operate WC8VOA as well as special event station W8Y at the headquarters hotel.

some interest, he said, but no one was really able to get a plan together.

I had already mentioned to them that I thought the National Voice of America Museum of Broadcasting near Cincinnati (*Photo A*) would be the perfect location (*Photo B*). He and Sam had some reservations, but soon realized that the camp would have to take a slightly different shape in the USA than in Europe. I spend time at the VOA museum when I can, and I suggested to some of the staff that the museum would be a good location for the camp.

They agreed.

So a few days later, I called Sterling, "So … about this YOTA camp. What do you think about me taking it on?"

His response: "Well, I just heard you volunteer." I told him I'd put together a proposal, and he could run it by the Dayton Amateur Radio Association (DARA), organizers of the Dayton Hamvention®, which had also expressed support for the idea. So, we began the planning process.

The Planning Begins

Gary West, K8DEV, one of the museum's board members, was all in favor and was willing to support the idea. He put me in contact with so many different people in the community that he knew could help with this project. I put together a committee of Sam; Sterling; Jocelyn Brault, KD8YRX (better known as Chris Brault, KD8YVJ's, dad) who was already doing a lot of educational outreach for the West Chester Amateur Radio Club at the museum; and me.

We started meeting on Zoom to talk about what the camp proposal would look like. We ran with it. I started making a master schedule, reviewed Sam and Sterling's report from their Austria trip, and started developing a budget. As budget items were added, so were liability and insurance concerns. As we planned more and more, we had pretty well shaped what the camp would look like.

We started looking for donors at Hamvention. So many people were very positive, and offered their immediate assistance. I kept on planning, while we started adding up the numbers to see if we could make it a reality. It took longer than we expected to reach our self-imposed goal of three-fourths of the necessary funding, but we did it. And, despite starting on insurance all the way back at the second-ever meeting, it was still the last thing on the agenda to be completed before the announcement took place. I was working ahead the entire time, recruiting workshop leaders, staff and volunteers, and contacting suppliers. Most of my summer vacation from teaching high school chemistry was spent on camp preparations. Finally, in early November, we had an all-clear.

It felt like being a launch director for a space mission. Budget? Go for launch. Staff? Go for launch. Both male and female chaperones? Go for launch. Special event callsign? Go for launch. Kings Island amusement park understanding what in the world ham radio is, and it's OK to bring radios into the park? Go for launch. Background checks? Go for launch. Insurance? Insurance? Did I mention insurance? Go for launch. It was finally time to announce that the camp was indeed a reality.

A Jam-Packed (But Fun) Schedule

The schedule of activities is really a "top 10" list. We dreamed big, and it looks like it's working just fine. All the pieces just started to fall together as time went on. What makes YOTA different from most other youth-oriented events is that mostly peers will lead the workshops. In Region 1, great success was discovered when hams of similar ages taught each other. Our goal was to have over half of our workshops led by youth. We were able to exceed that goal.

When the campers arrive on Sunday, June 21, 2020, they will have a chance to tour the Voice of America museum

Photo D. Chris Brault, KD8YVJ, soldering. Participants in the YOTA camp will all get a kit-building opportunity.

exhibits and see some amazing technology and history from the past. As the museum closes and the camp formally begins, they will get to see amazing technology from the present. ICOM is providing an IC-7610 at every operating station, both at the museum (*Photo C*) and at the camp hotel across the street. IC-9700s will be used for satellite communications, and every camper will get an ICOM D-STAR-capable handheld to use for the week. After their orientation in the ham shack, dinner will be served, along with an inspirational talk from Tim Duffy, K3LR. Once everyone gets to know each other, it'll be off to the hotel for orientation on the other shack we'll be using for the week.

On Monday, we'll start off with contesting. Two of the biggest youth stars in contesting — Marty Sullaway, NN1C, and Bryant Rascoll, KG5HVO — will teach the campers an all-encompassing lesson about on-air competition. In the afternoon, campers will do a kit-build (*Photo D*) with locals Dr. Jack Purdum, W8TEE (the author of *Arduino Projects for Amateur Radio*) and Al Peters, AC8GY. After dinner, the campers will participate in an "eyeball sprint," and have some dedicated operating time on the special event station, which will have the callsign W8Y.

On Tuesday, the day will start with a workshop on digital modes. Ray Novak, N9JA, and Will Jourdain, AA4WJ, from ICOM, will be on hand to teach how D-STAR works and how to use their handhelds. Audrey McElroy, KM4BUN, will then teach about using APRS to track high-altitude balloons. In the afternoon, we will launch a balloon and track it. That evening, a social outing to Dave & Buster's promises to ignite some serious team building.

On Wednesday, the day will be spent at Kings Island amusement park, and the handhelds will come along. Yes, it will be a fun experience for everyone and a great chance to get to know each other

Photo E. Chris, KD8YVJ, and his cousin, J.J. Brannock (not yet licensed), foxoring. Foxoring combines amateur radio direction finding (foxhunting) with orienteering, or navigating with map and compass. Foxoring will be part of this summer's YOTA Camp program.

better. But it will also be a learning experience. At various times throughout the day while at Kings Island, the campers will be operating a VHF sprint. They will choose their position in the park and call on one of four simplex frequencies in a quest to work as many other campers as possible.

Thursday morning will feature Ruth Willet, KM4LAO, conducting a workshop on satellite operation, and campers will team up using their handhelds to make some satellite contacts. In the afternoon, a Foxoring (combination foxhunting and orienteering) competition will take place in the park behind the VOA museum (*Photo E*). The night will finish with a pizza and pool party.

On Friday morning, Joe Fitter, K7JOE, will conduct an antenna building workshop. Then, there will be more time for satellite contacts and special event station contacts before the closing ceremonies. Field Day 2020 begins the next day, so we will be releasing everyone by 4 p.m. so they can get home to their own Field Day. Or, everyone is invited to stay (on their own) for the West Chester ARA Field Day at the museum.

Your Help is Needed

In order to make this camp affordable, we need your assistance. Thanks to our equipment sponsors (ICOM America, Heil Sound, X-Tronic, and R&L Electronics) and our major financial supporters (the YASME Foundation, the World Wide Radio Operators Foundation, Orlando Hamcation and Orlando Amateur Radio Club, the Northern California DX Foundation, Dayton Hamvention and Dayton Amateur Radio Association, the Huntsville Hamfest, the ARRL Foundation, Southwest Ohio DX Association, Radio Amateurs of Canada, and Gary West, K8DEV, and Dee Dee West, KA8DXE) over $50,000 worth of equipment and contributions have already been made.

The last $5,000 needs to come from you, the amateur radio community. If you would like to support our cause financially, please visit our website at <youthontheair.org>, and click on the donate button. You can donate online via PayPal or GoFundMe. If we go above our $5,000 goal, we can add more spots for more campers and begin planning the next camp. Our hope is that this camp expands to multiple locations each summer all across the Western Hemisphere.

We also need pileups on the air, so these campers can practice their skills throughout the entire week. Please get on the air between June 21 and 26 and work us. We also need you to help us find campers across not just North America, but all of North, Central, and South America. Please spread the word.

Thank you so much for your support. We hope to hear you on the air soon. Be sure to watch our YouTube channel for daily videos during the camp showing what we've accomplished. Work our special event station, W8Y, and, watch for the results and reflections of the camp right here in *CQ* magazine.

Notes:

1. For more info, visit <https://yarc.world/ycp/>
2. Youngsters on the Air is a program of Region 1 of the International Amateur Radio Union (IARU), which covers Europe, Africa, and the Middle East. Since 2012, the Region 1 YOTA program has sponsored summer camps for young hams in different countries. For more information, visit <www.ham-yota.com>.

Results of the 2019 CQ World Wide VHF Contest

BY JOHN "JK" KALENOWSKY,* K9JK

What a pleasant surprise for my first year as CQWW VHF Contest Director. The 27-hour contest period provided some interesting conditions with 951 logs submitted, and an additional 25 submitted as checklogs for a total of 976. This eclipsed the most recent high count of 907 logs from 2016. There was some regional e-skip in the U.S. on 2 meters early in the contest period. as shown in the log of Jay, W1VD. His comment on 3830scores.com noted: *"Highlight was the sporadic-E opening(s) Saturday afternoon with nine stations worked in eight grids ... EM09 (KS), EM17 (KS), EM27 (KS), EM31 (TX), EN10 (NE), EN20 (NE), DM78 (CO), and DM79 (CO)."* One of the stations that Jay contacted was Ken, WØETT, who reported that Connecticut was a new state for him on 2 meters. Wyatt, ACØRA/R, operating solo this year and despite losing almost an hour of operating time to replace the belt tensioner on his rover mobile, even managed to better the U.S Rover score record that he and Dave, KG5CCI, had just shattered in 2018.

K1JT's WSJT-X continues to impact this contest. 2017 was the first test of FT-8, 2018 was a "real" test, and 2019 was even testier with an additional 'flavor' added in to the mix, FT-4 (I sure hope Joe is not going try and top Baskin-Robbins, with 31, or more, flavors of digital modes. –*JK*). As was the case in 2018, there was almost always activity on 50.313 MHz and more stations tried 144.174 MHz (or other local FT-8 watering holes) for 2 meters.

Six meters was the most popular band with over 70,000 QSOs reported (in 832 logs) as compared to just shy of 9,400 QSOs on 2 meters (in 452 logs). According to the mode reported on "QSO:" lines in the logs, "PH" was the most popular, with 31,669 (45%) of the 6-meter QSOs and 5,403 (57%) of the 2-meters contacts. "DG" or "RY" was the choice for 41% of QSOs on 6 meters versus 22% of QSOs on 2 meters. "CW" was also popular on 6 meters with 9,523 contacts reported on "the original digital mode." FM activity was significant on 2 meters with 1 in 6 QSOs reporting using the mode.

USA

Of the 951 logs that were scored, U.S. stations in the contiguous 48 states submitted 593. By category, Single Operator, Single Band, 6 meters was the most popular with 271 logs. Single Operator, All Band was not too far behind with 232 logs. The remaining 90 logs from U.S. participants consisted of 30 Rovers, 26 Single-op QRP, 16 Multi-op, 12 2-meter only and 6 Hilltoppers. By call area, 4-land is the champion with

Bill, W4NQP, on 6 meters and Jon, KD4AMP, on 2 meters at N4SVC, 2019's top scoring Multi-op effort (Courtesy of Steve Kostro, N2CEI)

2019 CQWW VHF PLAQUE WINNERS AND DONORS

SINGLE OPERATOR, ALL BAND

WORLD: Dr. Gene Zimmerman, W3ZZ Memorial, sponsored by Directive Systems and the Grid Pirates. Won by: **Aleksandr Maksimov, EA8DBM**
USA: Steve Bolia, N8BJQ Trophy. Won by: **Jeff Klein, K1TEO**

SINGLE OPERATOR, SINGLE BAND

WORLD 50 MHz: Jorge F. Rios Alvarado, XE2X Trophy. Won by: **Salvatore Tortoreti, IT9XTP**
USA 50 MHz: Dennis Motschenbacher, K7BV Trophy. Won by: **Dan Street, K1TO**
WORLD 144 MHz: CQ VHF Contest Committee Trophy, sponsored by Bostjan Sever, S56P. Won by: **Bostjan Sever, S56P**
USA 144 MHz: Chuck Dietz, W5PR Trophy. Won by: **Jay Rusgrove, W1VD**

ROVER

USA: Northern Lights Radio Society Trophy: Won by: **Wyatt Dirks, ACØRA**

MULTI-OPERATOR

WORLD: Dr. Gene Zimmerman, W3ZZ Memorial, sponsored by Directive Systems and the Grid Pirates. Won by: **HA6W (op: HAØLC, HAØLZ, HAØMK, HAØLO, HAØMP, HA6WX, HA6ZFA, HA5OKU**
USA: Bob Striegl, K2DRH Trophy: Won by: **N4SVC (op: KD4AMP, W4NQP, N2CEI)**

CLUB

USA: Director's Trophy, sponsored by JK Kalenowsky, K9JK. Won by: **Society of Midwest Contesters**

**Denotes awarded to runner-up in category*

Emaiil: k9jk.cq@gmail.com

154 logs. The 9th call area was the source of 63 logs, just edging ahead of 5-land and 7-land with 62 logs each. Next was Ø-land with 52, followed by 2-land with 50. The 1st and 8th call areas matched each other with 44 logs. The 3rd call area provided 39 logs and California wrapped it up with 23 logs.

Jeff, K1TEO, claimed the U.S. top spot in Single Operator, All Band, with 671 QSOs on 6 and 130 QSOs on 2. Jeff's multiplier counts were also impressive, 162 grids contacted on 6 and 42 on 2 meters. Focusing just on 6 meters, Dan, K1TO, collected 700 QSOs and contacted 203 grids (that's VUCC TWICE in 27 hours of operating) from his Florida station to earn the best U.S score in the Single Operator, 6-Meter only category. As noted in the introduction, ACØRA/R bettered his record-breaking Rover category score from 2018, finding another 13,000 points to raise the bar even higher for Rovers in the future. Wyatt's 568 QSOs on 6 plus 121 on 2 netted him a score that was almost 10 times that of his closest competitor, who just happens to have been your contest director and author of this article. In the Single Operator, All Band QRP category, Jim, KO9A, achieved a score of 48,510, the highest U.S. score in the category since 2007. Jim relied heavily on digital modes with 172 of his 298 reported contacts reporting "RY" as the mode. The U.S. top score for Single Operator, Single Band, 2 meters was claimed by Jay, W1VD, with 103 contacts in 54 grid locators (including some distant locators as mentioned in the introduction). Dan, W1QK, logged 25 QSOs and 16 multipliers, all on 6 meter, to top the Hilltopper category in the U.S. In multi-operator, the three operators of N4SVC amassed 679 total QSOs for a final score of 150,903, just edging ahead of the team of eight operators that piloted the K5QE station by just over 2,100 points.

The Society of Midwest Contesters repeat as the U.S. club competition leader with 26 entries netting a total score of 678,607. ACØRA/R's rover and K2DRH's SOAB efforts were almost two-thirds of the club's aggregate score.

TOP SCORES

WORLD

All Band

EA8DBM	174,324
DL2OM	129,117
EA6SA	50,553
VE3WY	24,966
IK7LMX	24,552

6 Meters

IT9XTP	94,830
XE2X	72,930
EA6VQ	63,244
E73S	51,324
IT9BDM	36,096

2 Meters

S56P	25,344
HA8IH	20,130
YO2LSP	5,920
E74G	5,312
US8AR	4,440

Hilltopper

HA1ZH	7,222
HA2VR	6,630
IZ2JNN/IN3	1,620
UT1IC	1,392
OM3KHT	1,200

QRP

IZ8WGU	8,932
YO8SSB	4,800
USØYA	2,419
E74BYZ	2,064
VE2NCG	1,550

Rover

VA3ELE/R	2,170
E27DIX/R	1,672
RAØLQ/R	468
VE3OIL/R	378

Multi-Op

HA6W	123,246
IR9K	107,300
VE3SMA	42,795
4O6BLM	38,220
J48KEF	21,012

USA

All Band

K1TEO	189,924
K2DRH	140,693
N2NT	102,784
WA4GPM	99,372
N3MK	74,800

6 Meters

K1TO	142,100
KC4PX	121,176
N4BP	113,520
W5PR	99,640
N4EEB	89,760

2 Meters

W1VD	11,124
K1HC	1,116
WE7L	768
WØLGQ	544
WØRT	408

Hilltopper

W1QK	400
AD4IE	256
W1MR	56

QRP

KO9A	48,510
NØUR	24,486
WA5DM	7,956
K3TW	6,213
AC5O	5,780

Rover

ACØRA/R	327,240
K9JK/R	34,034
N2SLN/R	30,186
WD9HBF/R	25,760
NU4E/R	22,504

Multi-Op

N4SVC	150,903
K5QE	148,736
W4VHF	133,724
W3SO	107,261
N8GA	78,916

DX

There were 358 logs received from all six continents.

Continent	Logs	# of different DXCC Countries
Africa	5	3
Asia	70	8
Europe	197	34
Oceania	8	1
South America	27	4
North America (other than U.S.)	51	8

Ukraine lead the way with a total of 40 logs submitted. Canada was close behind with 36. From Thailand, 29 logs were received with many of them multi-operator entries representing participation by another 80 licensees. Among DX logs submitted, Single Operator, Single Band, 6 meters was the most popular category with 129 entries. With 58 entries each, Single Operator, All Band and Single Operator, Single Band, 2 meters were next; and Single Operator, All Band, QRP followed closely with 56 log submissions. The remaining 57 DX entries consisted of 35 Multi-operator (16 of those from Thailand), 18 Hilltoppers, and 4 Rovers.

Aleksandr, EA8DBM, continued his streak as the top scorer in the Single Operator, All Band category among DX entries with 553 QSOs on 6 meters and 22 on 2 meters. Aleksandr's multiplier count on 6 meters was quite impressive, with 280 different grid squares recorded in his log. In the remaining single operator categories for the DX entries — Salvatore, IT9XTP, completed 545 QSOs in 174 multipliers for the best 6-meter Single Band score; Bostjan, S56P, logged 198 QSOs in 64 different grid locators to lead the world's Single Band, 2 meter entrants; Giuseppe, IZ8WGU, claimed the DX top score in the All Band, QRP category, though all of his 116 QSOs and 77 multipliers were completed on 6 meters; and the leading Hilltopper score was achieved by Zoltan, HA1ZH, with 96 QSOs in 46 grid locators.

Hungary was home to the leading Multi-operator category score among DX entrants. A team of eight operators at HA6W logged 172 contacts on 6 meters and 283 on 2 meters. Rover activity outside the U.S. remained scarce, with only 4 entries. Peter, VA3ELE/R, lead the "DX" Rovers.

Four logs submitted by members of the HA-DX-CLUB netted them the top DX score in the club competition with a total score of 137,178. The HA6W Multi-op entry produced 90% of the club's score.

The Rest of the Story

The CQWW VHF Contest will return for 2020 on July 18th and 19th. Mark your calendar and make your plans now. No

Kyle, KG6BXW, took this "selfie" during his first time Rover run (Photo by Kyle Hamilton, KG6BXW)

First time rover Kyle, KG6BXW/R, shows his rover mobile setup at Vista Point along California's I-5 just south of Patterson, grid locator CM97kk. (Photo by Kyle Hamilton, KG6BXW)

ROVERS & GRIDS OPERATED

AA5PR DM55 DM74 DM75
ABØYM DM78 DM79 DM88 DM89 DN70 DN71 DN80
ACØRA EM59 EM69 EN31 EN32 EN40 EN41 EN42 EN50 EN60
AE5P EM20 EM21 EM22 EM30 EM31 EM32
AE8AT EM79 EN70
AF1R FN32 FN33 FN42 FN43
E27DIX OK02 OK03 OK04 OK05 OK06
K2EZ . . . . . EM69 EM79 EM89 EM99 EN41 EN50 EN51 EN52 EN60 EN80 . . . . . EN90 FM09 FM19 FN00
K9ILT & KØPG EN50 EN51 EN60 EN61
K9JK EM59 EM69 EN50 EN51 EN52 EN60 EN61 EN62
KA9VVQ & W9FZ EN24 EN25 EN34 EN35
KC9CSH EM49 EM59 EN40 EN50
KE7MSU CN85 CN86 CN87
KG6BXW CM86 CM87 CM96 CM97
KK4BZ FM08 FM09 FM18 FM19
KT5TE EM20 EM21 EM22 EM30 EM31 EM32
N1SV FN33 FN42 FN43
N2MH EM81 EM82 EM92
N2SLN & KB2YSI FN02 FN11 FN12 FN22 FN23
N6GP DM03 DM04 DM13 DM14
N6RH EM20 EM21 EM22 EM30 EM31 EM32
N8OC EN57 EN67 EN73 EN74 EN75 EN76 EN83
N9GH EN51 EN61
NU4E & W4EEY EM84 EM85
NV4B/R EM51 EM52 EM53 EM61 EM62
RAØLQ KN51 KN52 KN62
VA3ELE EN93 EN94 FN03
VE3OIL FN24 FN25 FN35 FN36 FN46
W1RGA FN32 FN33 FN42 FN43
W3DHJ DM77 DM78 DM87 DM88
W4POT EL99 EM90
WA4JA EM65 EM66
WB2SIH & W2LYN FN21 FN22 FN31 FN32 FN33
WD9HBF EM59 EN40 EN41 EN50 EN51

QSO & GRID LEADERS

6-Meter QSOs

K1TO	700
K1TEO	671
N4BP	645
N4SVC	629
KC4PX	612
ACØRA/R	568
EA8DBM	553
IT9XTP	545
N4EEB	544
W5PR	530
WA4GPM	518
KØSIX	503
K2DRH	503
K5QE	490
KU8E	486

2-Meter QSOs

HA6W	283
E27AAA	223
E27AC	216
E22EEO	203
S56P	198
HA8IH	183
W4VHF	142
K1TEO	130
E23SGP	128
ACØRA/R	121
DL2OM	119
HS9JGQ	114
9A1I	111
HS6LFC	105
W1VD	103

6-Meter Grids

ACØRA/R	307
EA8DBM	280
K1TO	203
KC4PX	198
W5PR	188
N4SVC	183
N4BP	176
IT9XTP	174
DL2OM	174
K5QE	171
WA4GPM	170
K9FA	169
N4EEB	165
XE2X	165
EA6VQ	163

2-Meter Grids

ACØRA/R	97
HA6W	73
S56P	64
W4VHF	58
HA8IH	55
W1VD	54
K5QE	53
DL2OM	49
W3SO	48
K2DRH	44
N8GA	42
K1TEO	42
YO2LSP	40
N2NT	40
4O6BLM	38

The radio... YAESU

True RF Legend
True Performance

FT DX 5000MP Limited

RF μ-Tuning Unit
(Optional)

■ Provides ultra-high-Q RF preselection selectivity

Congratulations

We congratulate WRTC 2018 Y81N Winning Team from Lithuania

The winners of the World Radio Team Championship 2018
Gedas Lucinskas (LY9A) and Mindis Jukna (LY4L)

Rig used: 2 x FTDX5000MP

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changes in the rules are anticipated but check the May 2020 edition of *CQ* magazine and I expect to have the rules for 2020 posted on the CQ VHF website <http://cqww-vhf.com> before the end of March. The email robot has been retired so the web uploader on the CQ VHF website will be the only way to submit logs and I believe the bugs that were encountered in 2019 have all been addressed. In addition to the Cabrillo format, an option to submit logs in ADIF format will be available. It still needs some testing to ensure it can produce usable log files, but it is hoped that all will be ready by the time of next year's contest.

Repeating past director Steve's constant plea, if you operate, please send in a log. Any size log is greatly appreciated. If you need help, please ask. More logs make cross-checking more accurate. Please send digital photos as well.

Thanks to Director Emeritus Steve, N8BJQ, for his support in my first year as director of the contest. Additional thanks to Champ, E21EIC, and Yuri, UT1IC, for their efforts to encourage activity (and log submissions) in their respective countries, Thailand and Ukraine.

Don't forget to check out the CQ WW VHF Contest website <http://cqww-vhf.com>. Comments, suggestions, and corrections are always welcome. Quite a bit of the data was entered manually. If you find an error, please let us know.

CLUB COMPETITION

(Minimum of 3 entries required for listing)

UNITED STATES

Club Name	# Entries	Score
SOCIETY OF MIDWEST CONTESTERS	26	678,607
POTOMAC VALLEY RADIO CLUB	47	569,040
FLORIDA CONTEST GROUP	19	440,936
NORTH EAST WEAK SIGNAL GROUP	11	377,770
FLORIDA WEAK SIGNAL SOCIETY	3	272,235
DFW CONTEST GROUP	5	170,169
CAROLINA DX ASSOCIATION	6	163,509
MT AIRY VHF RADIO CLUB	7	161,185
ROCHESTER VHF GROUP	17	138,428
TEXAS DX SOCIETY	4	115,811
NORTHERN LIGHTS RADIO SOCIETY	8	110,981
SOUTH EAST CONTEST CLUB	5	99,488
ARIZONA OUTLAWS CONTEST CLUB	20	91,355
CENTRAL TEXAS DX AND CONTEST CLUB	4	88,766
BADGER CONTESTERS	9	84,773
TENNESSEE CONTEST GROUP	7	78,087
NEW MEXICO VHF SOCIETY	8	75,201
CTRI CONTEST GROUP	3	71,981
MICHIGAN VHF-UHF SOCIETY	3	60,927
FRANKFORD RADIO CLUB	10	57,241
PACIFIC NORTHWEST VHF SOCIETY	23	50,208
MAD RIVER RADIO CLUB	4	40,824
YANKEE CLIPPER CONTEST CLUB	9	39,778
HUDSON VALLEY CONTESTERS AND DXERS	3	37,182
GRAND MESA CONTESTERS OF COLORADO	12	37,111
ALABAMA CONTEST GROUP	5	32,627
THE VILLAGES AMATEUR RADIO CLUB	3	19,835
SOUTHERN CALIFORNIA CONTEST CLUB	6	16,882
NORTHERN CALIFORNIA CONTEST CLUB	7	13,234
MINNESOTA WIRELESS ASSN	4	12,091
NORTH COAST CONTESTERS	3	10,797
METRO DX CLUB	3	9,988
KENTUCKY CONTEST GROUP	3	9,734
BRISTOL (TN/VA) ARC	3	8,528
BERGEN ARA	3	6,578
SILVER COMET AMATEUR RADIO SOCIETY	5	5,953

DX

HA-DX-CLUB	4	137,178
CONTEST CLUB ONTARIO	8	55,562
UKRAINIAN CONTEST CLUB	11	37,822
CONTEST GROUP DU QUEBEC	5	10,863
CROATIAN CONTEST CLUB	3	9,000
RHEIN RUHR DX ASSOCIATION	3	5,340
UKRAINIAN VHF INTERNATIONAL CONTEST CLUB	6	4,707
BAVARIAN CONTEST CLUB	4	3,672
CDR GROUP	7	702
CONTEST CLUB SERBIA	11	486
CABREUVADX	8	438

Number/letter groups after call letters denote the following: Class (A = all band, 6 = 6 meters, 2 = 2 meters, Q = QRP, Q* = QRP portable hilltopper, R = rover. M = multi-operator), Final Score, Number of QSOs, Number of grid locators, State/Province (USA/Canada only), Grid Locator or Number of grids activated (rover only). Rover scores for USA are listed separately. Scores in bold indicate certificate winners. Score in italic are disqualified.

2019 VHF RESULTS
NORTH AMERICA

UNITED STATES

K1TEO	**A**	**189,924**	**801**	**204**	**CT**	**FN31**
W1XX	**A**	**62,689**	**422**	**139**	**RI**	**FN41**
AF1T	**A**	**54,981**	**399**	**123**	**NH**	**FN43**
N1JEZ	**A**	**31,720**	**235**	**122**	**VT**	**FN44**
K1KA	A	31,654	252	119	NH	FN42
W1FKF	A	26,676	196	117	NH	FN43
NE1B	A	17,014	169	94	NH	FN42
K1GQ	A	10,125	135	75	NH	FN43
K2KA	**A**	**7,437**	**106**	**67**	**MA**	**FN42**
K1ZK	A	7,259	116	61	VT	FN34
N1API	A	5,406	97	53	CT	FN31
W1FJ	A	3,220	70	46	MA	FN42
W1AN	A	2,806	59	46	CT	FN41
N4NIV	A	1,170	38	30	MA	FN42
K1DVL	A	638	28	22	CT	FN31
K1LMY	A	320	20	16	MA	FN32
W3EP	**6**	**44,250**	**375**	**118**	**CT**	**FN31**
W1RM	6	18,083	169	107	CT	FN31
N2KW	**6**	**9,660**	**138**	**70**	**MA**	**FN32**
WA1KRG	6	6,630	102	65	CT	FN31
						Op: W1QK
K1SX	6	6,486	94	69	MA	FN41
AE1T	**6**	**5,220**	**87**	**60**	**NH**	**FN43**
K1KI	6	2,728	62	44	CT	FN32
KA1J	6	1,862	49	38	CT	FN31
K1YWW	6	1,628	44	37	MA	FN42
KC1GWX	6	702	27	26	MA	FN42
N1ADX	6	667	29	23	MA	FN42
K1AR	6	630	30	21	NH	FN42
N1WRK	6	204	17	12	MA	FN41
W1ZFG	6	130	13	10	CT	FN31
K1MTD	6	120	12	10	CT	FN31
N1CGP	**6**	**100**	**10**	**10**	**ME**	**FN54**
W1GXZ	6	64	8	8	MA	FN42
K1VUT	6	56	8	7	MA	FN41
W1VD	**2**	**11,124**	**103**	**54**	**CT**	**FN31**
K1HC	**2**	**1,116**	**31**	**18**	**ME**	**FN53**
N1PRW	**Q**	**1,305**	**42**	**29**	**MA**	**FN42**
K8CN	**Q**	**88**	**11**	**8**	**NH**	**FN43**
W1QK	**H**	**400**	**25**	**16**	**CT**	**FN31**
W1MR	**H**	**56**	**6**	**7**	**NH**	**FN43**
W1FM	**M**	**8,505**	**128**	**63**	**MA**	**FN42**
					Ops: W1FM, N1SOH	
N2NT	**A**	**102,784**	**485**	**176**	**NJ**	**FN20**
						Op: N2NC
N2WK	**A**	**31,080**	**238**	**120**	**NY**	**FN03**
N2YB	A	26,300	221	100	NY	FN12
N2SLO	A	24,892	223	98	NY	FN30
N2BEG	A	14,186	153	82	NY	FN12
WA2VNV	A	12,780	121	90	NY	FN30
KA2ENE	A	11,988	139	81	NY	FN13
WA3AFS	A	7,326	101	66	NY	FN32
NA2NY	A	6,732	91	66	NY	FN33
AA2TT	A	6,552	89	56	NY	FN30
K2AMI	A	6,254	90	59	NJ	FN20
K2RMX	A	5,830	85	55	NY	FN20
W2KV	A	3,675	63	49	NJ	FM29
N2RC	A	3,128	57	46	NY	FN21
W9KXI	A	2,993	55	41	NY	FN12
WW2Y	A	2,356	52	38	NJ	FN20
KD2LGX	A	1,952	41	32	NY	FN13
KF2TV	A	1,344	38	32	NY	FN13
W2CCC	A	1,312	39	32	NY	FN23
Op: K2CS						
K3WHD	A	1,080	36	27	NY	FN13
N2NKX	A	952	32	28	NY	FN22
N2RJ	A	920	40	23	NJ	FN21
W2YR	A	667	27	23	NJ	FN20
KQ2N	A	420	23	30	NY	FN23
KC2LYK	A	374	22	17	NJ	FN20
KC2JRQ	A	56	7	7	NY	FN30
W2GFV	A	25	5	5	NJ	FN20
K2XA	**6**	**29,232**	**252**	**116**	**NY**	**FN32**
K2SDS	**6**	**26,001**	**243**	**107**	**NJ**	**FM29**
KZ2I	6	16,732	178	94	NJ	FM29
K2ZD	6	5,146	83	62	NY	FN21
N2OO	6	4,158	77	54	NJ	FM29
N2CJ	6	2,242	59	38	NJ	FN30
K2PAL	6	1,836	51	36	NY	FN30
K2OEQ	6	1,710	45	38	NY	FN13
K2DH	6	1,395	45	31	NY	FN13
N2SO	6	624	26	24	NY	FN31
W2CVW	6	621	27	23	NJ	FN20
K2HVE	6	567	27	21	NJ	FM29
KV2X	6	437	23	19	NY	FN13
WB2KHE	6	169	13	13	NY	FN21
W2UDT	6	49	7	7	NJ	FN20
WA2CHV	6	1	1	1	NY	FN12
NA2X	**2**	**56**	**7**	**4**	**NY**	**FN13**
W2JEK	**Q**	**228**	**19**	**12**	**NJ**	**FN20**
KA2YRA	**Q**	**96**	**9**	**6**	**NY**	**FN21**
KR2AA	Q	81	9	9	NY	FN20
K3ZO	**A**	**67,799**	**423**	**151**	**MD**	**FM18**
W3LL	A	43,820	289	140	MD	FM19
N3HBX	A	33,720	275	120	MD	FM19
KR1ST	**A**	**31,707**	**241**	**117**	**PA**	**FN21**
N3XF	A	9,709	127	73	PA	FN00
K1BZ	A	8,024	114	68	MD	FM19
N3NGE	A	7,424	108	64	PA	FN20
KD3HN	A	6,993	110	63	PA	FM19
WB3IGR	A	5,546	76	59	PA	FN10
NA3M	A	3,417	67	51	MD	FM19
KC3BVL	A	2,772	51	42	PA	FM29
N3MWQ	**A**	**2,730**	**55**	**39**	**DE**	**FM29**
W3DF	A	2,106	54	39	MD	FM19
K3MD	A	980	35	28	PA	FN10
WA3PTV	A	936	28	26	PA	FM19
N3KUN	A	693	29	21	MD	FM18
NC3Y	A	460	23	20	MD	FM19
W3AVP	A	84	7	6	PA	FN10
K3ISH	**6**	**22,458**	**197**	**114**	**PA**	**FN21**
K3UA	6	6,900	100	69	PA	EN90
W3TA	6	5,016	88	57	PA	FN20
AA3S	**6**	**4,968**	**92**	**54**	**MD**	**FM19**
W3ZGD	6	3,312	69	48	PA	FM19
						Op: K3MSB
K3SWZ	6	2,880	60	48	PA	FN10
K3ZA	6	2,562	61	42	PA	FM29
W3OU	6	1,656	46	36	MD	FM18
N1SZ	6	1,450	50	29	MD	FM19
N3DUE	6	960	40	24	MD	FM19
K3HX	6	868	31	28	PA	FN00
AC3BU	6	620	31	20	MD	FM19
W3IUU	6	304	19	16	MD	FM19
N3TTT	**6**	**144**	**12**	**12**	**DE**	**FM29**
KF3G	6	81	9	9	PA	FM29
WD3H	6	42	6	7	PA	FN20
N3QE	6	15	5	3	MD	FM19
K3FAZ	**Q**	**144**	**12**	**12**	**PA**	**FN00**
W3SO	**M**	**107,261**	**443**	**199**	**PA**	**FN00**
			Ops: W3IDT, W3XOX, W3YOZ, WA3TTS, W3BC, W3BTX			
WA3EKL	**M**	**27,417**	**199**	**111**	**MD**	**FM19**
				Ops: WA3EKL, AC3BU, K3LU, KM4ND		
W3RFC	M	6,804	98	63	MD	FM19
			Ops: W3RFC, K3OQ, K$$OO, WA3OFF			
WA4GPM	**A**	**99,372**	**532**	**182**	**FL**	**EM90**
N3MK	**A**	**74,800**	**395**	**170**	**VA**	**FM27**
N4HB	A	66,240	363	160	VA	FM17
W3IP	A	54,144	319	141	VA	FM19
N4QWZ	**A**	**36,960**	**235**	**140**	**TN**	**EM66**
K2SX	**A**	**35,728**	**308**	**116**	**SC**	**FM03**
KK4MA	A	33,634	246	134	SC	EM92
NG4C	**A**	**27,219**	**203**	**129**	**NC**	**FM16**
KC4NX	A	22,500	220	100	TN	EM75
WB7PMP	A	22,149	195	107	NC	EM95
N4QV	A	19,240	183	104	FL	EL96
K2PS	A	19,170	213	90	FL	EL98
K5VIP	A	16,072	154	98	VA	FM16
K4ZW	A	14,080	159	88	VA	FM18
AJ6T	A	13,114	147	83	AL	EM64
K9IL	A	8,364	123	68	TN	EM56
AI4WW	A	8,346	107	78	FL	EL96
KU4WW	**A**	**7,326**	**111**	**66**	**AL**	**EM64**
KS4S	A	7,245	105	69	NC	FM04
W8KHP	**A**	**6,120**	**88**	**68**	**KY**	**EM79**
WN2E	A	4,617	79	57	FL	EM60
N3KN	A	4,292	74	58	VA	EM97
K4LPQ	A	4,160	78	52	TN	EM86
K4LDC	**A**	**3,816**	**71**	**53**	**GA**	**EM74**
K4MY	A	3,640	64	52	GA	EM74
AA4DD	A	3,408	69	48	TN	EM86
WA4LDU	A	2,880	50	48	SC	EM93
K2MK	A	2,016	48	42	FL	EL98
N4YDU	A	1,890	54	35	NC	FM06
W4CWM	A	1,596	42	38	SC	FM03
N4PD	A	1,176	38	28	VA	FM19
K4BSK	A	1,110	36	30	NC	EM95
K4ELI	A	1,092	41	26	GA	EM74
W4EE	A	1,050	35	30	FL	EL98
KA3PCX	A	1,020	34	30	NC	FM15
KT4O	A	960	39	24	TN	EM86
W4ATL	A	896	31	28	GA	EM73
AF3K	A	864	32	27	FL	EL96
K4FTO	A	690	29	23	VA	FM18
K4HQK	A	624	26	24	VA	FM18

KI5FJ	A	576	23	24	VA	FM16
WB4MM	A	520	22	20	FL	EL99
N4NSS	A	380	20	19	FL	EL97
W4CU	A	221	17	13	FL	EL87
K4BBH	A	195	15	13	GA	EM73
KA4WJB	A	169	14	13	FL	EL89
KE4QCM	A	120	12	10	GA	EM73
W3YY	A	16	4	4	VA	FM18
K1TO	**6**	**142,100**	**700**	**203**	**FL**	**EL87**
KC4PX	6	121,176	612	198	FL	EL98
N4BP	6	113,520	645	176	FL	EL96
N4EEB	6	89,760	544	165	FL	EL99
KU8E	**6**	**59,778**	**486**	**123**	**GA**	**EM72**
N4PN	6	49,440	412	120	GA	EM82
AB4B	**6**	**48,290**	**439**	**110**	**AL**	**EM64**
K1HTV	**6**	**46,926**	**297**	**158**	**VA**	**FM18**
KM4HI	6	31,204	269	116	FL	EL89
W8HW	6	20,826	178	117	FL	EL97
WØPV	6	18,746	182	103	FL	EL87
K5EK	**6**	**18,252**	**169**	**108**	**NC**	**FM03**
N4ZY	**6**	**16,302**	**209**	**78**	**KY**	**EM56**
N3CKI	6	15,386	157	98	NC	FM03
AG4W	**6**	**14,028**	**161**	**84**	**AL**	**EM64**
N6AR	6	13,884	156	89	FL	EL98
W1AJT	6	10,686	137	78	NC	EM95
W4JF	**6**	**10,449**	**129**	**81**	**SC**	**FM03**
WF7T	6	9,035	139	65	TN	EM66
N1IA	6	8,892	114	78	NC	FM05
KN4Y	6	7,239	127	57	FL	EM70
NH6T	6	6,804	108	63	AL	EM63
K4SQC	6	6,510	105	62	GA	EM74
W5MX	6	6,490	110	59	KY	EM77
K6EID	6	5,655	87	65	GA	EM73
N4NIA	6	5,488	98	56	NC	EM85
NM4A	6	5,016	88	57	KY	EM78
KN4SM	6	4,914	78	63	VA	FM16
N9OU	6	4,779	81	59	FL	EL87
KJ4AOM	6	4,346	82	53	KY	EM77
W5NZ	6	4,094	89	46	AL	EM62
K3YDX	6	3,976	71	56	NC	FM05
W4INK	6	3,834	71	54	FL	EL87
KM3U	6	3,358	73	46	FL	EL87
KM2T	6	3,315	65	51	FL	EL87
WD4OHD	6	3,060	68	45	TN	EM75
N4GLE	6	2,964	76	39	AL	EM64
NI7R	6	2,838	66	43	SC	EM92
AA4NP	6	2,816	64	44	FL	EL98
K4BAI	6	2,760	69	40	GA	EM72
AE4M	6	2,520	60	42	AL	EM64
KI4UX	6	2,496	64	39	AL	EM64
WB4EHG	6	2,024	46	44	FL	EL96
W4RYW	6	1,924	52	37	AL	EM72
N3JT	6	1,734	51	34	VA	FM18
WE5P	6	1,680	48	35	KY	EM77
N2QT	6	1,677	43	39	VA	FM07
KD4EE	6	1,624	56	29	KY	EM79
K4CGY	6	1,584	44	36	VA	FM07
W4PF	6	1,564	46	34	KY	EM78
N4MM	6	1,518	46	33	VA	FM09
KC8KSK	6	1,512	42	36	SC	FM03
KM4SLW	6	1,440	45	32	GA	EM72
WA4DYD	6	1,386	42	33	GA	EM83
KW4G	6	1,260	42	30	FL	EL97
K4QE	6	1,184	37	32	NC	FM05
WC4H	6	1,116	36	31	FL	EL95
K4YYL	6	1,102	38	29	SC	EM84
N4DU	6	1,102	38	29	GA	EM71
N4RA	6	1,044	36	29	VA	FM09
KM4IAJ	6	1,015	35	29	VA	FM18
AD4XT	6	924	33	28	GA	EM72
AC4G	6	880	44	20	TN	EM65
W4CAR	6	775	31	25	VA	FM16
KA4RRU	6	720	30	24	VA	FM18
KM4VTE	6	682	31	22	GA	EM73
K4MI	6	648	27	24	VA	FM17
W4WNT	6	575	25	23	NC	EM94
NØSMX	6	441	21	21	FL	EL98
WA4JQS	6	432	24	18	KY	EM77
K4MJA	6	418	19	22	FL	EL95
K4DET	6	399	21	19	VA	FM17
WA6POZ	6	294	21	14	FL	EM70
W4VIC	6	266	19	14	VA	FM16
KN9W	6	255	15	17	TN	EM75
KS4X	6	240	16	15	TN	EM75
WF4R	6	240	15	16	VA	FM16
K3ZGA	6	224	16	14	FL	EL98
K3TD	6	221	17	13	NC	FM05
W1AM	6	196	14	14	GA	EM84
N3UA	6	182	14	13	VA	FM17
K4SHW	6	168	14	12	GA	EM73
KX4KU	6	156	13	12	VA	FM08
WA4TMJ	6	56	8	7	VA	FM16
K4PO	6	42	7	6	AL	EM62
WV4V	6	36	6	6	FL	EL87
W4NWB	6	30	6	5	SC	EM85
KA4NDY	6	25	5	5	AL	EM63
KW4LU	**2**	**2**	**1**	**1**	**TN**	**EM86**
K3TW	**Q**	**6,213**	**109**	**57**	**FL**	**EL88**
K4YFH	**Q**	**420**	**20**	**21**	**NC**	**FM04**
KEØJMK	Q	357	20	17	NC	EM85
KG2E	**Q**	**304**	**19**	**16**	**KY**	**EM66**
NZ1D	Q	143	11	13	FL	EL98
KN4LGM	**Q**	**90**	**10**	**9**	**GA**	**EM73**
AD4IE	**H**	**256**	**15**	**16**	**NC**	**EM96**
N4SVC	**M**	**150,903**	**679**	**207**	**FL**	**EM80**
			Ops: KD4AMP, W4NQP, N2CEI			
W4VHF	**M**	**133,724**	**520**	**202**	**NC**	**EM96**
		Ops: W3DQS, W3GQ, KU4V, W3OA, N4UFP, KI4TZ, W4GRW				
W4NH	**M**	**65,816**	**409**	**152**	**GA**	**EM84**
			Ops: W4ZST, W4KXY, WG8S			
WB4WXE	**M**	**29,760**	**243**	**120**	**AL**	**EM74**
				Ops: WB4WXE, KB4ZFA		
AA5AM	**A**	**43,200**	**289**	**144**	**TX**	**EM13**
KV5W	A	22,736	199	112	TX	EM22
WB2FKO	**A**	**20,710**	**179**	**109**	**NM**	**DM65**
N5SYV	**A**	**17,170**	**152**	**101**	**LA**	**EM32**
WB5TUF	A	9,882	122	81	TX	EL29
KB7IJ	A	8,715	103	83	TX	EM12
N5ITO	A	7,705	106	67	TX	EM23
KD5J	**A**	**6,710**	**122**	**55**	**AR**	**EM45**
AJ4F	A	6,120	90	68	TX	EL29
WA5LFD	A	4,450	79	50	TX	EM12
WR5AY	A	3,024	67	42	TX	EM12
AI5AA	A	2,990	65	46	LA	EM40
WØVX	A	2,730	65	42	TX	EM12
KD5JHE	**A**	**2,583**	**63**	**41**	**MS**	**EM54**
KC7QY	A	2,508	54	44	NM	DM64
N5XJ	A	1,287	39	33	TX	EM10
KC5RET	A	1,020	33	30	TX	EM20
K5OLV	A	608	32	19	MS	EM54
KI5MM	A	368	18	16	TX	EM12
N5EPA	A	288	17	16	NM	DM64
KV5TX	A	224	14	14	TX	EM00
W5PR	**6**	**99,640**	**530**	**188**	**TX**	**EL29**
WQ5L	**6**	**54,912**	**429**	**128**	**MS**	**EM50**
K9FA	6	54,587	323	169	TX	EM10
N5RZ	6	29,952	234	128	TX	EM00
KG5THG	6	18,480	168	110	TX	EM02
N5TJ	6	17,978	178	101	TX	EM13
W5KI	**6**	**17,888**	**172**	**104**	**AR**	**EM36**
KJ5RC	6	13,624	131	104	MS	EM42
NN5T	6	12,348	147	84	TX	EM12
AE5VB	**6**	**9,922**	**121**	**82**	**LA**	**EM50**
KF4EWO	6	8,107	121	67	MS	EM54
K5CKS	6	6,464	101	64	AR	EM25
W5TRL	6	5,610	85	66	TX	EM10
WA2VJL	6	4,346	82	53	TX	EL16
W5JAY	6	4,080	80	51	AR	EM26
K5YVY	6	3,572	76	47	MS	EM54
KF5BA	6	3,525	75	47	MS	EM50
NZ5X	6	3,283	67	49	TX	DM96
KG5IEE	6	1,989	51	39	TX	EM22
K5TA	**6**	**1,925**	**55**	**35**	**NM**	**DM65**
K7ZYV	6	1,026	38	27	MS	EM50
AF5Q	**6**	**850**	**34**	**25**	**OK**	**EM04**
K5UV	6	696	29	24	OK	EM15
W5GAI	6	550	25	22	MS	EM50
K5XU	6	546	26	21	MS	EM42
AA5AU	6	500	25	20	LA	EL49
NØLD	6	460	23	20	OK	EM15
NW5Q	6	357	21	17	TX	EM13
K5IUA	6	180	12	15	TX	EL29
K5TU	6	169	13	13	TX	EL29
KD5JDS	6	99	11	9	NM	DM72
W5TJS	6	9	3	3	OK	EM15
NM5WB	6	8	4	2	NM	DM65
WA5DM	**Q**	**7,956**	**111**	**68**	**TX**	**EM12**
AC5O	**Q**	**5,780**	**85**	**68**	**LA**	**EL49**
K5QE	**M**	**148,736**	**577**	**224**	**TX**	**EM31**
						Ops: K5QE, K5MQ, N5YA, N1XS, AE5AE, KC4SW, AF8Z, KA5D
KC5MVZ	M	1,064	37	28	TX	DM93
				Ops: KC5MVZ, KE5BZO		
WA6ZTY	**A**	**8,442**	**118**	**67**	**CA**	**CM98**
K9YC	A	2,183	59	37	CA	CM87
W6ZAR	A	1,488	47	31	CA	DM13
N6ORB	A	640	40	16	CA	CM87
N4DLA	A	588	31	14	CA	CM87
KM6PHB	A	451	30	11	CA	CM87
KC6ZWT	A	312	19	13	CA	CM98
N6QQ	**6**	**7,920**	**120**	**66**	**CA**	**DM03**
WM6Y	6	3,956	86	46	CA	DM13
N6ZE	6	2,960	74	40	CA	DM04
NC6K	6	1,680	56	30	CA	DM13
WB6IZG	6	697	41	17	CA	DM13
KO6LU	6	460	23	20	CA	CM87
K6NR	6	456	24	19	CA	DM14
W6ZL	6	154	14	11	CA	DM13
AE6JR	6	1	1	1	CA	DM04
AG6AG	6	1	1	1	CA	DM04
KG6DNY	**2**	**100**	**10**	**5**	**CA**	**DM04**
K2GMY	**Q**	**1,044**	**48**	**18**	**CA**	**CM88**
W1UO	Q	200	20	10	CA	DM13
WD6DX	Q	18	6	3	CA	CM96
N7IR	**A**	**12,654**	**148**	**74**	**AZ**	**DM43**
N7GP	A	12,600	154	72	AZ	DM42
NR7T	**A**	**11,544**	**132**	**74**	**UT**	**DM37**
KY7M	A	8,514	126	66	AZ	DM33
W7FI	**A**	**8,296**	**120**	**61**	**WA**	**CN87**
AI1K	A	5,796	86	63	AZ	DM34
WA7XX	A	4,482	65	54	AZ	DM42
KE7SW	A	3,264	80	32	WA	CN87
K7YDL	**A**	**2,929**	**78**	**29**	**OR**	**CN85**
W7OJT	A	2,760	54	46	AZ	DM24
K1IEB	A	2,059	53	29	AZ	DM43
K7ULS	A	2,040	45	40	UT	DN41
N7EPD	A	1,890	52	30	WA	CN76
KD7UO	A	1,452	53	22	WA	CN87
K9DR	**A**	**1,386**	**42**	**33**	**WY**	**DN62**
N7VD	A	1,378	42	26	AZ	DM43
KX7L	A	1,026	49	19	WA	CN87
K7XC	**A**	**1,008**	**42**	**21**	**NV**	**DM09**
N7NEV	A	920	33	23	AZ	DM43
N6LB	A	731	33	17	WA	CN98
N7QOZ	A	708	34	12	WA	CN87
N7DB	A	555	29	15	OR	CN85
N6KW	A	407	29	11	WA	CN87
N7MZW	A	357	21	17	WY	DN71
KG7P	A	350	29	10	WA	CN87
KK7CO	A	308	17	14	AZ	DM43
						Op: W7ON
K7HP	A	240	22	10	AZ	DM33
NJ7A	A	187	14	11	UT	DN30
W7MTL	A	39	11	3	OR	CN85
AF7VC	A	32	5	4	OR	CN85
K7CW	**6**	**11,620**	**166**	**70**	**WA**	**CN87**
AB7E	**6**	**3,519**	**69**	**51**	**AZ**	**DM41**
N7CW	6	2,880	60	48	AZ	DM34
W6OAT	6	2,800	80	35	WA	CN87
K7HKR	6	1,998	54	37	AZ	DM34

KK7AC	6	1,749	53	33	AZ	DM53
K7BHM	6	1,470	49	30	AZ	DM43
K7JQ	6	1,152	48	24	AZ	DM43
K1YR	6	1,056	44	24	AZ	DM33
K7WLF	6	962	37	26	AZ	DM22
K9RZ	6	456	24	19	AZ	DM33
WA7BRL	6	420	35	12	WA	CN87
KF6HI	6	399	21	19	AZ	DM33
K6UM	**6**	**308**	**22**	**14**	**OR**	**CN85**
N7TE	6	209	19	11	OR	CN84
WI7P	**6**	**208**	**16**	**13**	**UT**	**DN40**
K7SMA	6	162	18	9	OR	DN13
W7VXS	6	112	16	7	WA	CN87
W7TZ	6	99	11	9	OR	CN83
K7BWH	**6**	**88**	**11**	**8**	**ID**	**DN27**
AI9Q	6	48	12	4	WA	CN85
KE7GKI	6	36	9	4	AZ	DM33
W6ABM	6	9	3	3	OR	CN82
KC1BB	6	1	1	1	AZ	DM32
N7RK	**2**	**396**	**22**	**9**	**AZ**	**DM33**
N9NA	2	32	4	4	AZ	DM33
N7XCZ	**Q**	**135**	**15**	**9**	**NV**	**DM09**
KF7KTC	Q	0	0	1	NV	DM09
K7ATN	**H**	**20**	**5**	**2**	**OR**	**CN95**
K7IMA	**H**	**20**	**5**	**2**	**OR**	**CN95**
NN7AZ	**M**	**34,932**	**252**	**123**	**AZ**	**DM32**
			Ops: NN7AZ, W4IX, KC7V, WO7R			
K8ZR	**A**	**46,292**	**297**	**142**	**OH**	**EN91**
KB8U	**A**	**21,060**	**155**	**108**	**MI**	**EN71**
K8MR	A	11,703	125	83	OH	EN91
N8VW	A	7,104	108	64	OH	EN80
KF8QL	A	7,062	92	66	MI	EN72
N8II	**A**	**6,272**	**98**	**64**	**WV**	**FM19**
AA8MA	A	4,590	83	54	OH	EN80
N8GLS	A	3,822	58	49	OH	EN91
N8XA	A	3,102	58	47	OH	EM89
N8CWU	A	2,106	53	39	OH	EM89
WB8WKQ	A	1,610	43	35	MI	EN82
W8KNO	A	1,428	39	34	OH	EN91
AK4FL	A	1,376	36	32	OH	EM89
N8TFD	A	810	30	27	OH	EM79
K3JT	A	720	30	24	WV	EM99
WB8WUA	A	504	22	18	OH	EN91
AC8WC	A	238	17	14	MI	EN73
WD8NHI	A	25	5	5	OH	EM79
W7JW	**6**	**32,805**	**243**	**135**	**MI**	**EN82**
N8BJQ	**6**	**25,868**	**221**	**116**	**OH**	**EN80**
K9NW	6	22,260	210	106	OH	EM79
W3HKK	6	5,251	89	59	OH	EN80
KC8QDQ	6	4,300	86	50	OH	EM89
AA8SW	6	4,256	76	56	OH	EM79
W8KEN	6	3,555	79	45	OH	EN91
K8MU	6	3,283	67	49	MI	EN82
NS8O	6	2,009	49	41	OH	EM89
WB8YLO	6	1,428	42	34	OH	EN81
KD8VMM	6	1,190	35	34	OH	EN81
K7DR	6	1,152	36	32	MI	EN82
AA8TA	6	620	31	20	OH	EN80
K8GQ	**6**	**378**	**21**	**18**	**WV**	**EM98**
W1NN	6	342	19	18	OH	EN91
WA8ZIP	6	195	15	13	OH	EN91
W8MRL	6	150	15	10	OH	EM79
N8ZVT	6	80	8	10	MI	EN75
KF8MZ	6	42	7	6	OH	EN70
W8MDE	6	9	3	3	OH	EN80
N8DZR	**2**	**50**	**5**	**5**	**MI**	**EN73**
AB8FJ	**Q**	**28**	**7**	**4**	**OH**	**EM79**
N8GA	**M**	**78,916**	**354**	**181**	**OH**	**EN80**
			Ops: N8ZM, K8DZ, WB8ART, W8BFT, W8PLZ, N8UR			
NA1WJ	**M**	**3,650**	**73**	**50**	**WV**	**EM97**
			Ops: AB5EB, AD5A, K5ND, NE4RD			
K2DRH	**A**	**140,693**	**605**	**199**	**IL**	**EN41**
W9GA	**A**	**44,446**	**279**	**142**	**WI**	**EN53**
W9EWZ	A	41,168	295	124	WI	EN52
KOØZ	A	20,448	191	96	IL	EM59
K8SD	A	18,054	160	102	WI	EN52
WA9TT	A	12,232	115	88	WI	EN54
W9DZ	**A**	**7,085**	**98**	**65**	**IN**	**EN61**
K9MU	A	6,161	94	61	WI	EN44
ND9Z	A	5,712	83	68	WI	EN54
K9ZF	A	4,104	59	54	IN	EM78
W9HQ	A	3,608	77	44	WI	EN43
N9UUR	A	2,279	52	43	WI	EN63
N4IY	A	1,888	55	32	IN	EM78
WT2P	A	1,539	57	27	IL	EN51
K9PG	A	1,290	43	30	IL	EN51
KT9L	A	900	26	25	IN	EM69
WB9HFK	A	900	34	25	IL	EN50
KC9UL	A	800	30	25	IL	EN50
N9VPV	A	800	31	25	IL	EN40
KC9ELU	A	540	20	20	IN	EM79
WV9E	A	414	21	18	WI	EN43
AI9T	A	255	17	15	IL	EM69
W9EBK	A	91	11	7	IL	EM59
N8HWV	A	72	9	8	WI	EN54
K9RMC	A	64	8	8	IL	EN40
WK9U	**6**	**50,148**	**398**	**126**	**WI**	**EN65**
K9OM	6	48,384	336	144	WI	EN65
W9JSP	6	7,904	104	76	WI	EN52
KD9MDE	6	6,901	103	67	WI	EN43
WA9LEY	**6**	**5,733**	**91**	**63**	**IL**	**EN61**
W3HDH	6	5,246	122	43	IL	EN50
W9ILY	6	3,723	73	51	IL	EN51
WI9WI	6	3,366	66	51	WI	EN45
N4TZ	**6**	**2,752**	**64**	**43**	**IN**	**EN70**
W9AV	6	1,961	53	37	WI	EN43
N9LF	6	1,750	50	35	IN	EN60
KB9RCL	6	1,634	43	38	WI	EN53
W9SE	6	1,632	48	34	IL	EN50
KD9VV	6	1,488	48	31	IN	EN71
NT9E	6	1,092	39	28	IL	EN52
NA9RB	6	1,073	37	29	IL	EN40
W9KVR	6	930	31	30	IL	EN60
K9CW	6	925	37	25	IL	EN50
WB8BZK	6	744	31	24	IL	EN52
WE9V	6	744	31	24	WI	EN52
K9PMV	6	532	28	19	IL	EN61
N9YLZ	6	315	21	15	IL	EN51
W9OSI	6	228	19	12	IL	EM49
K9GY	6	221	17	13	IL	EN61
W9VQ	6	208	16	13	IL	EN61
K9CT	6	135	15	9	IL	EN50
KC9WIB	6	42	7	6	IL	EN61
KO9A	**Q**	**48,510**	**286**	**147**	**IL**	**EN52**
K9AKS	Q	3,075	63	41	IL	EN41
WB9AYW	Q	1,044	36	29	IL	EN51
WS9V	**M**	**49,067**	**338**	**139**	**IL**	**EM59**
				Ops: WS9V, KD9GKL		
W9RVG	M	35,632	224	136	IL	EM57
				Ops: WD9EXD, W9RVG		
NØURW	**A**	**60,032**	**447**	**134**	**IA**	**EN41**
KØTPP	**A**	**48,924**	**283**	**151**	**MO**	**EM48**
W9RM	**A**	**35,306**	**231**	**139**	**CO**	**DM58**
K3PA	**A**	**29,294**	**302**	**97**	**KS**	**EM29**
WØETT	A	11,470	145	74	CO	DM79
KFØM	A	10,790	121	83	KS	EM17
WAØMHJ	**A**	**5,940**	**110**	**54**	**MN**	**EN35**
KØNR	A	5,394	74	62	CO	DM78
K5ZG	A	5,152	72	56	CO	DM88
KØVG	A	3,588	76	46	MN	EN27
WØZF	A	3,192	76	38	MN	EN34
NYØA	A	2,700	53	45	MN	EN24
NOØT	A	2,520	56	45	CO	DM79
NØIS	A	2,336	73	32	MO	EM48
NØGTO	A	1,500	48	30	CO	DM59
N5KB	A	1,250	50	25	IA	EN22
NØAT	A	1,144	40	26	MN	EN34
KØUK	A	338	19	13	CO	DM59
KØAWU	A	255	17	15	MN	EN37
KCØVDY	A	176	14	11	CO	DM59
KØAIZ	**A**	**100**	**10**	**10**	**NE**	**EN10**
AEØEE	A	54	8	6	MN	EN34
KØSIX	**6**	**73,438**	**503**	**146**	**MN**	**EN35**
K2DSW	**6**	**11,234**	**137**	**82**	**IA**	**EN31**
KØVM	6	8,025	107	75	IA	EN42
WØVTT	6	6,844	116	59	MN	EN33
WØJW	6	6,615	105	63	IA	EN31
KØBJ	**6**	**6,596**	**97**	**68**	**KS**	**DM99**
WØSEI	6	3,268	76	43	MN	EN35
WTØDX	**6**	**2,714**	**59**	**46**	**CO**	**DM79**
KØTRL	6	1,989	51	39	KS	EM28
WNØL	**6**	**1,248**	**39**	**32**	**NE**	**EN11**
KØNEB	6	1,148	41	28	NE	EN10
WXØZ	6	374	22	17	MN	EN35
KSØAA	6	210	15	14	KS	EM28
N2VHZ	6	196	14	14	NE	DN82
KCØCCR	6	182	14	13	KS	EM29
WAØLIF	6	135	15	9	MN	EN35
AKØMR	6	24	5	4	CO	DM59
KØZX	6	9	3	3	CO	DM79
WE7L	**2**	**768**	**24**	**16**	**CO**	**DM79**
WØLGQ	**2**	**544**	**17**	**16**	**IA**	**EN21**
WØRT	**2**	**408**	**17**	**12**	**KS**	**EM27**
KØKP	**2**	**32**	**4**	**4**	**MN**	**EN36**
NØUR	**Q**	**24,486**	**223**	**106**	**MN**	**EN33**
WBØIWG	**Q**	**4,872**	**87**	**56**	**ND**	**EN06**
KIØG	**Q**	**20**	**5**	**4**	**CO**	**DM69**
NØJK	**H**	**20**	**5**	**4**	**KS**	**EM28**
NØKE	**M**	**121**	**11**	**11**	**CO**	**DM69**
					Ops: NØKE, ADØLI	

Rover

ACØRA/R	**R**	**327,240**	**689**	**404**	**9**
K9JK/R	**R**	**34,034**	**205**	**143**	**8**
N2SLN/R	**R**	**30,186**	**188**	**129**	**5**
WD9HBF/R	**R**	**25,760**	**211**	**115**	**5**
NU4E/R	**R**	**22,504**	**182**	**116**	**2**
AE5P/R	**R**	**17,204**	**172**	**68**	**6**
NV4B/R	**R**	**16,892**	**162**	**103**	**5**
K2EZ/R	**R**	**16,274**	**128**	**103**	**14**
N6RH/R	**R**	**12,320**	**147**	**56**	**6**
KT5TE/R	**R**	**11,752**	**151**	**52**	**6**
AA5PR/R	**R**	**10,960**	**133**	**80**	**3**
N8OC/R	**R**	**7,872**	**96**	**82**	**7**
K9ILT/R	R	7,350	91	70	4
KK4BZ/R	**R**	**6,111**	**96**	**63**	**4**
ABØYM/R	**R**	**6,072**	**81**	**69**	**7**
KE7MSU/R	**R**	**5,203**	**104**	**43**	**3**
N6GP/R	**R**	**5,184**	**86**	**54**	**4**
WB2SIH/R	R	4,914	74	54	5
KA9VVQ/R	**R**	**4,134**	**70**	**53**	**4**
W3DHJ/R	R	3,496	55	46	4
AF1R/R	**R**	**3,234**	**61**	**42**	**4**
N9GH/R	R	2,646	49	42	2
N1SV/R	R	2,583	47	41	3
W1RGA/R	**R**	**1,219**	**37**	**23**	**4**
N2MH/R	**R**	**506**	**23**	**22**	**3**
KC9CSH/R	R	437	23	19	4
KG6BXW/R	R	384	24	16	4
W4POT/R	**R**	**156**	**13**	**12**	**2**
WA4JA/R	**R**	**108**	**9**	**12**	**2**
AE8AT/R	**R**	**8**	**2**	**2**	**2**

BELIZE

V31MA	**6**	**340**	**20**	**17**	**EK58**

CANADA

VE3WY	**A**	**24,966**	**206**	**114**	**ON**	**FN04**
VE3DS	A	15,416	144	94	ON	FN03
VE7DAY	**A**	**8,591**	**117**	**71**	**BC**	**CO70**
VE3ZV	A	4,085	64	43	ON	EN92
VE2DSB	**A**	**4,056**	**78**	**52**	**QC**	**FN35**
VA2BN	A	3,082	63	46	QC	FN36
VE3RVZ	A	800	31	25	ON	FN04
VE3AYR	A	696	29	24	ON	FN03
VE3FJ	A	552	24	23	ON	FN03
VA3TIC	A	432	24	18	ON	FN14
VE2HAY	A	108	9	9	QC	FN35
VE2JCW	A	49	6	7	QC	FN35
VE4VT	**6**	**12,705**	**165**	**77**	**MB**	**EN19**
VA3PC	**6**	**5,580**	**93**	**60**	**ON**	**FN06**
VE2EBK	**6**	**5,100**	**85**	**60**	**QC**	**FN46**
VE2LG	**6**	**2,360**	**59**	**40**	**QC**	**FN35**
VE3TM	6	2,280	60	38	ON	FN25
VA3SK	6	1,976	51	38	ON	FN06
VA7ST	**6**	**1,462**	**43**	**34**	**BC**	**DO00**
VE3GFN	6	1,305	45	29	ON	FN03
VE3QN	6	650	26	25	ON	FN25
VE5MX	**6**	**437**	**23**	**19**	**SK**	**DN89**
VE3VHB	6	272	17	16	ON	FN24
VE6AX	**6**	**210**	**15**	**14**	**AB**	**DO20**
VE3OAT	6	156	13	12	ON	FN25
VE3ZY	6	121	11	11	ON	FN25
VE2KHC	6	36	6	6	QC	FN35
VE9RLW	**6**	**9**	**3**	**3**	**NB**	**FN57**
VE6CSX	6	4	2	2	AB	DO21
VA3ZNW	6	1	1	1	ON	FN03
VE2GT	**2**	**35**	**5**	**5**	**QC**	**FN36**
VE2NCG	**Q**	**1,550**	**43**	**31**	**QC**	**FN35**
VE3CRU	**H**	**30**	**5**	**3**	**ON**	**FN03**
VA3ELE/R	**R**	**2,170**	**38**	**31**	**ON**	**3**
VE3OIL/R	**R**	**378**	**21**	**18**	**ON**	**5**
VE3SMA	**M**	**42,795**	**270**	**135**	**ON**	**FN05**
				Ops: VE3MM, VE3RX, VE3SMA		

COSTA RICA

TI2CDA	**6**	**616**	**28**	**22**	**EJ79**

CUBA

CM2RSV	**6**	**24,182**	**214**	**113**	**EL83**
T4ØRCT	**6**	**22,000**	**220**	**100**	**FL10**
					Op: CO8ZZ

DOMINICAN REPUBLIC

HI8DL	**A**	**5,858**	**95**	**58**	**FK58**

GUATEMALE

TG9ANF	**6**	**2,301**	**59**	**39**	**EK44**

MEXICO

XE2CQ	**A**	**17,600**	**177**	**88**	**DM12**
XE2X	**6**	**72,930**	**442**	**165**	**EL06**
6E6M	**6**	**17,019**	**183**	**93**	**EL60**
XE2JS	**6**	**13,640**	**155**	**88**	**DL78**
XE2TT	**6**	**1,110**	**37**	**30**	**DL44**
XE1GZU	**6**	**792**	**33**	**24**	**DL80**
XE3WM	**6**	**81**	**9**	**9**	**EL51**
XE1EE	**6**	**1**	**1**	**1**	**DL90**

PUERTO RICO

KP4AJ	**Q**	**675**	**27**	**25**	**FK68**

AFRICA

CANARY IS.

EA8DBM	**A**	**174,324**	**575**	**292**	**IL18**
EA8AQV	**A**	**1,840**	**46**	**40**	**IL28**
EA8ED	**6**	**256**	**16**	**16**	**IL28**

GHANA

9G2HO	**6**	**4**	**2**	**2**	**JJ06**
					Op: 9G5SA

MOROCCO

CN8KD	**6**	**2,420**	**55**	**44**	**IM63**

ASIA

ASIATIC RUSSIA

RAØLQ/R	**R**	**468**	**18**	**13**	**3**

ASIATIC TURKEY

TA3NEB	**6**	**1,734**	**51**	**34**	**KM38**
TA7OM	**6**	**1,178**	**38**	**31**	**KN80**
TA9J	**6**	**1,147**	**37**	**31**	**LN10**
TA2IB	**6**	**156**	**13**	**12**	**KN41**
TA2FB	**6**	**120**	**12**	**10**	**KN40**
TA2OLS	6	72	9	8	KN41
TA7K	6	42	7	6	KN80
TC4A	**6**	**9**	**3**	**3**	**KM37**
					Op: TA4CS
TC3H	**M**	**984**	**41**	**24**	**KM38**
					Ops: TA3LHH, TA3EL
YM2KL	**M**	**600**	**23**	**15**	**KN50**
					Ops: TA1E, TA2AEO, TA2OHK

HONG KONG

VR2EH	**6**	**416**	**26**	**16**	**OL72**
					Op: VR2ZQZ

JAPAN

JQ1NGT	**A**	**2,295**	**94**	**17**	**PM95**
JF1RYU	**A**	**714**	**31**	**14**	**PM96**
JA6WFM	**6**	**2,448**	**102**	**24**	**PM52**
7L4IOU	**6**	**1,219**	**53**	**23**	**PM95**
JP1LRT	6	943	41	23	PM95
JF1MIA	6	30	10	3	PM95
JA1CRJ	6	1	1	1	PM95
JA7KPI	**6**	**1**	**1**	**1**	**QN00**
JF1WCK	6	1	1	1	PM95
JH1NXU	**6**	**1**	**1**	**1**	**PM96**
JH1PHK	6	1	1	1	PM95
JS1IFK	**2**	**190**	**19**	**5**	**PM95**
JH4PUS	**2**	**40**	**10**	**2**	**PM64**
JF7KWS	**2**	**18**	**9**	**1**	**QM09**
JJ7PMS	2	2	1	1	QM09
JR1NKN	**Q**	**12**	**4**	**3**	**PM95**
JN1OKV	Q	6	2	2	PM95
JK1TCV	**Q**	**4**	**2**	**2**	**PM96**
JE1ILP	Q	2	2	1	PM95
JJ1WWL/P	**H**	**96**	**12**	**8**	**PM96**
JH1VIX/1	**H**	**48**	**11**	**3**	**PM95**
JI1IKC	H	6	3	2	PM95
JR1UJX/6	**H**	**4**	**2**	**1**	**PM52**

KOREA

HL2ASZ	**6**	**77**	**11**	**7**	**PM37**

TAIWAN

BU2EP	**A**	**12**	**3**	**3**	**PL04**
BX2AGF	A	6	2	2	PL04

THAILAND

E23SGP	**2**	**2,816**	**128**	**11**	**OK04**
E25ETT	**2**	**2,040**	**85**	**12**	**OK12**
E2ØSJC	2	312	26	6	OK04
E24KHS	**2**	**112**	**14**	**4**	**OK14**
HS3LSE	2	56	7	4	OK14
E2A	**2**	**48**	**6**	**4**	**OK03**
					Op: E21EIC
E2ØYLM	**2**	**42**	**7**	**3**	**OK16**
E25CHP	2	36	9	2	OK03
HS8JKY	**2**	**2**	**1**	**1**	**NJ98**
E2ØWUE	**Q**	**8**	**2**	**2**	**OK03**
HS8LVC	**Q**	**6**	**3**	**1**	**NJ98**
HS6TUX	**H**	**24**	**6**	**2**	**NK96**
E27DIX/R	**R**	**1,672**	**38**	**22**	**3**
E27AAA	**M**	**9,366**	**223**	**21**	**OK04**
					Ops: E27AAA, HS3PJF, HS4QNU, HS4OSE, HS2RLP, E2ØOFS, E2ØZNH, E27GIG, E27DOH, E29VTH
E27AC	**M**	**7,344**	**216**	**17**	**OK03**
					Ops: E27EHE, E27IHO, E25HLF, E27CMS, E27HSN, E27ZJ
E22EEO	M	4,872	203	12	OK04
					Ops: E22EEO, HSØEDP, E22FFJ, E22WMI, HSØQQB, E22KKO, E25CIO
HS9JGQ	**M**	**3,420**	**114**	**15**	**OK06**
					Ops: E25HIN, E25HAM, E25GMU, E25AYM, E23RMJ, E23SUJ, E22SKN
HS6LFC	**M**	**3,360**	**105**	**16**	**OK14**
					Ops: E2ØWXA, HS5XWY, HS6LFC, E23YPF, E2ØXMG
HS4AK	**M**	**1,760**	**80**	**11**	**OK16**
					Ops: HS4LKW, HS4CQZ, E2ØOJU, E24YGI
HS7AP	**M**	**826**	**59**	**7**	**NK93**
					Ops: E2ØOMN, E24YEJ, HS7TSM, E24ETS, E29CCY, E24WRC, E29DJH, E29DVD, E29BRE
E29EKF	M	686	49	7	OK03
					Ops: E29EKF, E27GLL, E24MBA, E24JWC, E24SBC, E2ØWVV, E23HWU, E24PZJ
E27AH	M	486	27	9	OK16
					Ops: E24QND, HS4YQG, HS4YYZ, HS4YSB, HS4TDV
HS4RBP	**M**	**400**	**25**	**8**	**OK17**
					Ops: HS4RBP
E23QMG	M	310	31	5	OK04
					Ops: E23QMG, E22DBE, E23SKM, E22IUW, HSØQFL, HS6YSU, E24SLY, E23QCV, E23QNE, E24SMC
E28LX	**M**	**180**	**18**	**5**	**OK08**
					Ops: E28LX, HS5TUI, HS5ZQG, E24GLX, E22ZPP, HS5FAI, E22XDO, E22XDP
HS2AB	**M**	**150**	**15**	**5**	**OK12**
					Ops: HS2XNV, HS2UPR, HS2LPP
E24ICU	**M**	**52**	**26**	**1**	**OJ06**
					Ops: E24ICU, HS9PTY
HS6UUU	M	48	12	2	OK03
					Ops: HS6UUU, HS6MYW, HS6TIM, FAHSAI
HS5AM	**M**	**8**	**2**	**2**	**NK98**
					Ops: HS5IGY, HS1NSN

WEST MALAYSIA

9M4DXX	**6**	**1**	**1**	**1**	**OJ05**
					Op: JE1SCJ
9M2CDX	**Q**	**6**	**2**	**2**	**OJ11**
9W2VGR	**Q**	**1**	**1**	**1**	**OJ06**

EUROPE

AUSTRIA

OE3MDB	**2**	**1,224**	**34**	**18**	**JN88**

BALEARIC ISLANDS

EA6SA	**A**	**50,553**	**367**	**137**	**JM19**
EA6VQ	**6**	**63,244**	**388**	**163**	**JM19**
EC6DX	**6**	**4**	**2**	**2**	**JM29**

BELGIUM

ON6AT	**6**	**81**	**9**	**9**	**JO10**

BOSNIA AND HERZEGOVINA

E74G	**2**	**5,312**	**83**	**32**	**JN94**
E74BYZ	**Q**	**2,064**	**48**	**43**	**JN84**
E7ØAA	**H**	**800**	**26**	**20**	**JN93**

BULGARIA

LZ1ZJ	**6**	**483**	**23**	**21**	**KN12**
LZ2CH	**6**	**192**	**16**	**12**	**KN34**

CROATIA

9A6TT	**6**	**144**	**12**	**12**	**JN85**
9A2WB	**2**	**960**	**32**	**15**	**JN74**
9A2ZH	**Q**	**286**	**13**	**11**	**JN73**
9A1I	**M**	**6,882**	**111**	**31**	**JN85**
					Ops: 9A9I, 9A7IQG
9A1CEQ	M	1,974	47	21	JN85
					Ops: 9A4QI, 9A2TA

CZECH REPUBLIC

OK1DCP	**Q**	**64**	**8**	**8**	**JO70**
OK1RDO	**M**	**6,579**	**81**	**51**	**JN69**
					Ops: OK1DC, OK1NYD, OK1NMJ, OK1HRD

DENMARK

OZ9V	**6**	**72**	**9**	**8**	**JO46**

ENGLAND

G4PVM	**6**	**810**	**30**	**27**	**JO01**

ESTONIA

ES5TF	**6**	**144**	**18**	**8**	**KO38**
ES5TO	**M**	**322**	**23**	**7**	**KO29**
					Ops: ES5TF, VA3KMZ, ELINA OTT

EUROPEAN RUSSIA

RD3FD	**2**	**1,144**	**26**	**22**	**KO95**
RW3VA	**2**	**396**	**18**	**11**	**LO06**
RW6ACM	**2**	**120**	**10**	**6**	**KN94**

RA3EL	2	84	7	6	KO82
UA6AH	2	72	6	6	KN94
UA3YCX	2	60	6	5	KO73
RJ7M	2	24	4	3	KN97
RW3VM	2	2	1	1	KO94
UA6AX	Q	16	4	2	KN95
RX6APY	H	8	2	2	KN95

FINLAND

OH6AC	M	1,060	32	20	KP12
				Ops: OH6CS, OH6MCZ	

FRANCE

F5OQK	6	1,900	50	38	IN96
F6FTB	6	272	17	16	JN27
F6CZV/P	6	64	8	8	IN77
F4GFT	6	1	1	1	JN18
FØFEK/P	Q	280	14	10	JN19
F5OQK	6	1,900	50	38	IN96
F6FTB	6	272	17	16	JN27
F6CZV/P	6	64	8	8	IN77
F4GFT	6	1	1	1	JN18
FØFEK/P	Q	280	14	10	JN19

GERMANY

DL2OM	A	129,117	460	223	JO30
DH6DAO	A	2,214	51	41	JO41
DJ6TB	A	1,584	42	33	JN67
DK2OY	6	1,776	48	37	JO44
DL5YM	6	918	34	27	JO72
DL6RBH	6	195	15	13	JN69
DK2LO	6	117	13	9	JO43
DL4XU	6	30	6	5	JO53
DL1DBR	2	2,208	48	23	JO41
DL4SZB	Q	462	22	21	JO63

GREECE

SV3RPQ	6	10,730	145	74	KM18
SV2HJW	6	528	24	22	KN10
SV1NJX	6	25	5	5	KM18
IU2GID/SV8	6	1	1	1	KM37
J48KEF	M	21,012	193	103	KM08
				Ops: SVØFM, SV8CKJ, SV8SIV	

HUNGARY

HA8EV	A	120	10	8	KN06
HA3HX	6	4,592	82	56	JN86
HA7RF	6	440	22	20	JN97
HA8IH	2	20,130	183	55	KN06
HA5JX	2	234	13	9	JN97
HA5BA	Q	80	10	8	JN96
HA1ZH	H	7,222	96	46	JN86
HA2VR	H	6,630	83	51	JN87
HA6W	M	123,246	455	167	KN08
				Ops: HAØLC, HAØLZ, HAØMK, HAØLO, HAØMP, HA6WX, HA6ZFA, HA5OKU	

ITALY

IK7LMX	A	24,552	188	124	JN80
IH9YMC	A	12,960	138	90	JM56
IW1CHX	A	2,107	49	43	JN35
IZ4OSH	A	1,334	37	29	JN54
IT9XTP	6	94,830	545	174	JM68
IT9BDM	6	36,096	282	128	JM77
IZ5EME	6	15,768	146	108	JN52
IT9CKA	6	5,340	89	60	JM68
IU5ICR	6	2,193	51	43	JN53
I4LCK	6	1,692	47	36	JN54
I4JEE	6	1,505	43	35	JN54
IW1DQS	6	36	6	6	JN35
IT9JGX	2	8	2	2	JM67
IZ8WGU	Q	8,932	116	77	JM88
IZ2JNN/IN3	H	1,620	54	15	JN55
IR9K	M	107,300	492	185	JM67
				Ops: IT9DSZ, IT9KXK, IT9YMM, IT9HLC, IT9AOO, IT9WDC	

KALINGRAD

R2FI	2	234	13	9	KO04
UA2FL	Q	98	7	7	KO04

LATVIA

YL2LW	A	306	18	17	KO26
YL3AME	6	4	2	2	KO06

LITHUANIA

LY1R	6	2,288	52	44	KO14
LY5W	6	1,598	47	34	KO15
LY3BRA	6	56	8	7	KO14
LY2BBF	2	200	10	10	KO24

LUXEMBOURG

LX/G1TPA	Q	572	26	22	JO30

MONTENEGRO

4O6BLM	M	38,220	211	140	JN92
				Ops: 4O6ZD, 4O5JD	

NETHERLANDS

PA5WT	6	4,408	76	58	JO22
PAØO	6	3,196	68	47	JO33
PA2REH	6	306	18	17	JO22
PE2VAV	2	32	4	4	JO32
PAØFEI	Q	25	5	5	JO33

NORTH MACEDONIA

Z32KF	6	3,234	66	49	KN01
Z33B	Q	690	30	23	KN01

POLAND

SQ2EEQ	A	476	22	17	JO94
SP8SN	A	91	7	7	KO11
SP3UR	6	1,512	42	36	JO92
SP9EMI	6	256	16	16	JO90
SQ9LPO	6	56	8	7	JN99
SP2HHX	2	60	6	5	JO94
SP6LUV	Q	888	37	12	JO90
SQ9KPA	Q	105	9	7	JO90
SO7M	M	1,554	37	21	KO00
				Ops: SP8SIW	

PORTUGAL

CT7ABP	A	6,200	91	62	IM58
CT7AIX	A	121	11	11	IM59
CT1DIZ	6	23,343	251	93	IM58
CT7AUP	6	675	27	25	IM58

ROMANIA

YO5DAS	A	3,550	62	50	KN17
YO7FWS	A	1,968	41	24	KN24
YO2GL	A	1,271	36	31	KN05
YO5BRE	A	782	25	23	KN07
YO7LBX	6	8,249	113	73	KN15
YO7CJB	6	4,611	87	53	KN15
YQ6A	6	1,290	43	30	KN25
				Op: YO6BHN	
YO2LSP	2	5,920	74	40	KN05
YO8CLN	2	660	22	15	KN27
YO9CWY/P	2	468	18	13	KN35
YO9AYN/P	2	18	3	3	KN24
YO8SSB	Q	4,800	100	48	KN27
YO8DHA	Q	330	22	15	KN36
YO3GNF	Q	240	16	15	KN34
YO6KNE	M	2,916	54	27	KN26
				Ops: YO6DOY, YO6PNV, YO6CFB	

SARDINIA

ISØBSR	6	31,702	242	131	JN40

SERBIA

YU1ML	A	56	7	4	KN02
YU5T	A	16	4	2	KN12
YU1ANO	6	16	4	4	KN04
YTØI	Q	88	11	4	KN03
YT1BOB	Q	64	8	4	KN03
YT1ML	Q	30	5	3	KN02
YU3VIP	H	60	10	3	KN02
YU4RED	H	48	8	3	KN02
YU4GPS	H	30	5	3	KN02
YU4PPG	H	24	4	3	KN02
YT5L	M	40	10	2	KN13
				Ops: YU4IKA, YU4YES	
YU1HFG	M	30	5	3	KN02
				Ops: YU4JAN, YU4MOM	

SLOVAK REPUBLIC

OM3CW	6	868	31	28	JN88
OM3CM	6	169	13	13	JN88
OMØATR	2	2	1	1	KN09
OM3KHT	H	1,200	38	16	JN99

SLOVENIA

S52F	6	15,652	172	91	JN76
S56P	2	25,344	198	64	JN76

SPAIN

EA1HRR	A	5,888	84	64	IN83
EA2BFM	A	425	22	17	IN83
EA3FZT	6	15,531	167	93	JN01
EA5CH	6	7,119	113	63	IM98
EA1DHB	6	5,454	101	54	IN82
EA4CU	6	1,305	45	29	IN80
EA3ELZ	6	650	26	25	JN01
EA3GYE/P	Q	20	4	4	JN12

SWITZERLAND

HB9CAT	A	5,472	75	57	JN47

UKRAINE

UW8SM	A	22,500	185	100	KN28
UY5QZ	A	1,131	36	29	KN77
UT1KY/P	A	680	26	20	KO20
UX5UN	A	80	10	8	KO50
UX2QL	A	20	4	5	KN87
UXØFF	6	30,756	233	132	KN45
UT4XU	6	11,616	121	96	KO40
UR7EU	6	6,336	99	64	KN78
US8ZAL	6	5,187	91	57	KN66
UW7LL	6	3,408	71	48	KN79
USØKW	6	2,451	57	43	KO30
UV7E	6	1,728	48	36	KN77
UR5FA	6	580	29	20	KN56
UT7UA/P	6	475	25	19	KO20
UR5ECW	6	99	11	9	KN78
US8AR	2	4,440	60	37	KO60
US4IEK	2	2,688	56	24	KN87
UT8LE	2	1,800	36	25	KN79
UT8IK	2	972	27	18	KN87
UT9UR	2	840	21	20	KO40
UXØQQ	2	792	33	12	KN87
UR4LSK	2	480	16	15	KO80
UR7IM	2	396	18	11	KN88
UV8IF	2	154	11	7	KN88
UR7QDO	2	80	8	5	KN77
USØYA	Q	2,419	58	41	KN28
UT5VD	Q	950	28	25	KN68
UY5ON	Q	832	28	26	KN89
UR2Y	Q	690	30	23	KN27
					Op: USØYW
UT5ECZ	Q	644	28	23	KN68
UY2RA	Q	108	9	6	KO51
UR8QE	Q	90	9	5	KN77
UW5EGT	Q	40	5	4	KN67
US2IFR	Q	30	5	3	KN88
UR3QTN	Q	8	4	1	KN77
UR7QDU	Q	6	3	1	KN77
UR7QDV	Q	6	3	1	KN77
UT1IC	H	1,392	41	24	KN87
UR3INH	H	9	2	3	KN98
UT7E	M	4,628	81	52	KN78
				Ops: UT4EO, UR3EZ, UR5EFJ	

OCEANIA

EAST MALAYSIA

9W6AJA	Q	80	10	4	OJ75
9W6CTU	Q	10	5	1	OJ75
9W6PJM	Q	10	5	1	OJ75
9W6GEO	Q	8	4	1	OJ75
9W6MOZ	Q	8	4	1	OJ75
9W6MM	Q	6	3	1	OJ75
9W6NSP	Q	6	3	1	OJ75
9W6WOT	Q	6	3	1	OJ75

SOUTH AMERICA

ARGENTINA

LU9DO	A	10	3	2	GF05

BRAZIL

PU2KOB	A	156	13	6	GG56
PY2GTA	A	52	8	4	GG66
PY2REC	A	42	9	3	GG76
PY2DMZ	A	36	5	4	GG56
PU2OXB	A	4	1	2	GG56
PV8DX	6	567	27	21	FJ92
PU2NZO	2	42	9	3	GG76
ZY2R	2	24	6	2	GG66
					Op: PY2SFA
PT9BM	2	18	3	3	GH40
PP5ZCX	2	16	4	2	GG52
PU2OXU	2	10	5	1	GG66
PU5LTI	2	2	1	1	GG52
PU9DCB	2	2	1	1	GG27
PY2DPM	2	2	1	1	GG66
PY2MIA	2	2	1	1	GG66
PU2LFU	Q	68	11	4	GG76
PU2USK	Q	60	10	4	GG76
PU2MBY	Q	18	3	3	GG47
PP5ZT	Q	2	1	1	GG52
PU2XMY	Q	2	2	1	GG66
PY2ANY	M	576	34	9	GG66
				Ops: PY2ANY, PY2MIG, PY2LCD	
ZW5B	M	50	6	5	GG54
				Ops: PU2TIB, PY5CC	

TRINIDADS & TOBAGO

9Y4D	6	3,290	70	47	FK90
9Z4DZ	6	400	25	16	FK90

VENEZUELA

4M6R	A	11,440	138	80	FJ78
					Op: YV6CR
YY8VHF	A	27	5	3	FK80

CHECK LOGS

AK2L, HA1ZH, HA7LW, KØZX, K1IM, KD9EFO, OK4FF, RA6DE, SP3UR, UR5WCE, VE3ZY, VE7AFZ, YO9HP

Welcome to CQ's 75th anniversary issue! Amateur radio has undergone incredible changes since it came back to life after World War II, and CQ has been there every month to chronicle its progress and, frequently, lead the way. Here's a look back at highlights of the past 75 years of amateur radio as viewed through the lens of this magazine.

CQ Amateur Radio: 75 Years and Counting!

BY RICH MOSESON,* W2VU

The end of World War II marked many new beginnings in the world, including a new beginning for amateur radio and for a ham radio magazine that traced its roots to 1917. *Pacific Radio News* was launched that year in San Francisco, even as amateur radio itself was shut down for the duration of World War I. Initially, the "Pioneer Journal of Western Radio News and Development" covered all aspects of radio, both amateur and commercial. By 1933, in the midst of the Great Depression (which, ironically, was a boom time for ham radio), its name had been shortened to *Radio* and its focus had shifted entirely to amateur radio. *Radio* thrived in the years to follow, attracting some of the biggest names in the hobby to its pages and, in 1936, merging with competitor *R/9* to form a bigger and better-financed *Radio* magazine. World War II brought things to a screeching halt and, in 1944, *Radio* was sold to John Potts and Sanford "Sandy" Cowan. They split the magazine into two titles, with *Radio* being focused on broadcast engineering (it later became *Audio Engineering* and then *Audio* magazine, which was published until 2000) and the new *CQ*, devoted to amateur radio. The first issue of *CQ* was published 75 years ago this month, in January 1945 (*Photo A*), even as amateur radio remained shut down for the duration of World War II.[1]

That first issue's editorial contained a mission statement, one which each of the magazine's 11 editors has worked to uphold. Amazingly, even after 75 years, it is in no need of updating:

From the January 1945 issue:
This, then, is the raison d'etre for CQ — a magazine for the radio amateur, with a particular invitation to the newcomer. It should not, however, be inferred that we shall confine ourselves to the ABC's of ham radio. We visualize CQ as a magazine that will stick with the ham long after the parts of his first rig are dust-laden in the junk-box, and as a monthly refresher course for the old timer. While placing some emphasis on the elementary, we are still under obligation to carry through with articles on modern techniques and apparatus. Similarly, we shall follow up tradition (with which every ham must be familiar) with all the vital news of amateur radio today and tomorrow.

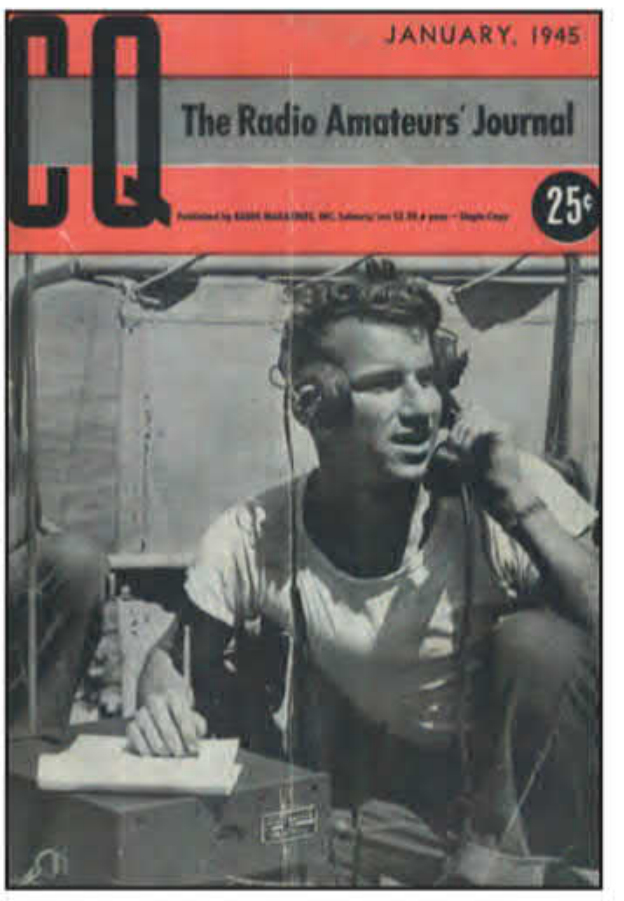


Photo A. CQ was launched 75 years ago this month, in January 1945, while World War II was still raging and ham radio was off the air.

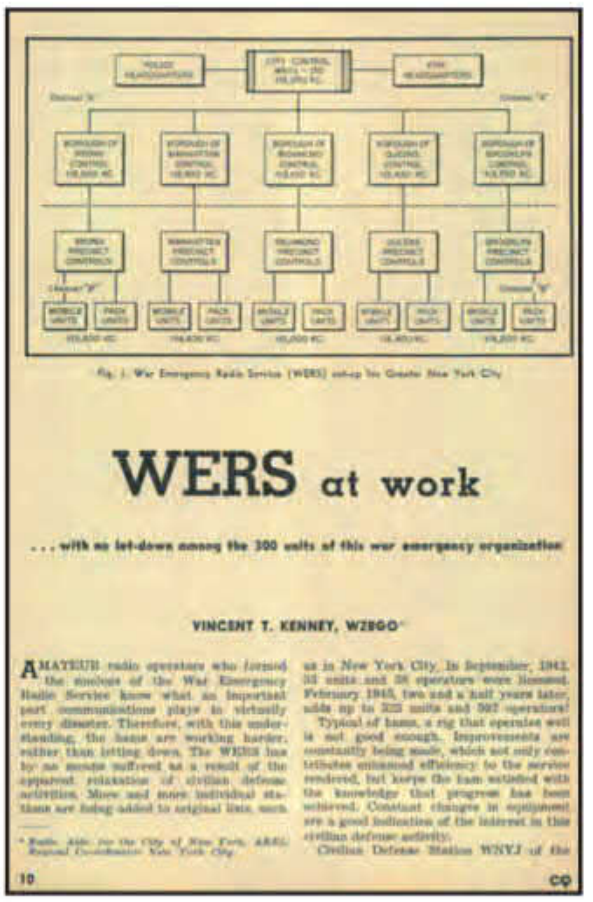
Radio Silence (Sort of)

When amateur radio operators returned to the airwaves after World War II, *CQ* was there to help them get back on the air, get back to DXing, contesting, and building. But the earliest issues appeared before the war had ended and before the ban on private radio transmitting had been lifted. Actually, America's 60,000 hams weren't entirely silent during the war. Thousands were deployed in every combat zone as radiomen; others worked in the electronics industry, building gear for use overseas. In addition, many amateurs who were unable to serve in uniform joined WERS, the War Emergency Radio Service. This precursor to today's Radio Amateur Civil Emergency Service, or RACES, operated on 112-116 Mc (to be correct for the time) and 219-225 Mc. Licenses were issued to communities, but operators were required to have held amateur licenses before the war.[2] The March 1945 issue of *CQ* featured an article on "WERS at Work" (*Photo B*).

The early issues of *CQ* offered technical articles as well as reporting on efforts to get amateur radio reauthorized once hostilities ended, and to secure more frequency bands than

* *Editor, CQ*
<w2vu@cq-amateur-radio.com>

before the war, including 15 meters and UHF / microwave allocations. It was widely anticipated that the number of hams would quickly grow to about 250,000, based on the number of people who'd received electronics training in the military and were expected to retain their newfound interest after the war. The lead article in the very first issue offered an introduction for newcomers to "Hams: Past, Present, Future." The second issue offered a fascinating article, "Looking Into the Future of Amateur Radio" (reproduced elsewhere in this issue), with predictions on station design as well as operating bands and modes. One interesting line from that article caught my eye, considering all the hams who regularly complain that newer hams are "appliance operators" who don't build gear the way they used to: "*The day when most 'hams' built their own equipment is past. The future will see the majority of amateur stations equipped with factory-built units.*" Remember, this was 1945. Looks like the "good ol' days" were farther back than we may think.



WERS at work

. . . with no let-down among the 300 units of this war emergency organization

VINCENT T. KENNEY, W2BGO*

AMATEUR radio operators who formed the nucleus of the War Emergency Radio Service know what an important part communications plays in virtually every disaster. Therefore, with this understanding, the hams are working harder, rather than letting down. The WERS has by no means suffered as a result of the apparent relaxation of civilian defense activities. More and more individual stations are being added to original lists, such as in New York City. In September, 1942, 35 units and 38 operators were licensed. February 1945, two and a half years later, adds up to 322 units and 502 operators!

Typical of hams, a rig that operates well is not good enough. Improvements are constantly being made, which not only contributes enhanced efficiency to the service rendered, but keeps the ham satisfied with the knowledge that progress has been achieved. Constant changes in equipment are a good indication of the interest in this civilian defense activity.

* Radio Aide for the City of New York, ARRL Regional Coordinator New York City. Civilian Defense Station WNYJ of the

10 CQ

Photo B. One way hams on the home front managed to stay on the air during the war was by signing up for WERS, the War Emergency Radio Service.

Back on the Air…

The FCC allowed hams back on the air in stages, starting with a couple of VHF bands and then reopening HF bands as military use decreased. Equipment manufacturers began shifting production from military to civilian radios, but the federal government threw a monkey wrench into the growth of the commercial ham market by releasing massive amounts of military communication gear onto the surplus market at a fraction of its original cost and retained value. Hams snapped up this gear and eagerly converted it for use on the amateur bands. It was a blow to the manufacturers but great for *CQ*, as articles on surplus conversion (*Photo C*) and ads from surplus dealers gave the new magazine the boost it needed to get onto a solid financial footing.

Tubes ruled the day, as did separate transmitters and receivers. Transistors came on the scene in 1948, but took a little while to find uses in ham stations. *CQ* had an ad from Raytheon in its June 1953 issue offering cash prizes for developing applications for its CK722 transistor; our September 1954 issue carried an article titled "First Experiments With Transistors" (reprinted in the October 2019 issue), and by December 1957, *CQ* had the first semiconductors column of any ham magazine, written by Don Stoner, W6TNS. It was in that column just a year-and-a-half later that Stoner briefly discussed plans to build a transistorized, solar-powered, 6-to-2-meter repeater that would be sent up in a balloon over the southwest to provide wide area coverage, famously adding, "Can any one come up with a spare rocket for orbiting purposes?" That line is generally acknowledged to have led directly to the birth of the amateur satellite program. Don became heavily involved in Project OSCAR (Orbiting Satellite Carrying Amateur Radio), as did *CQ* Propagation Editor George Jacobs, W3ASK, and columnist Bill Orr, W6SAI (see reprint of that column plus both Don's and George's recollections for our 50th anniversary elsewhere in this issue).

Propagation was another of *CQ*'s strong points in its early days (*Photo D*) — and it continues to be today — with only three propagation editors over 75 years helping to explain the mysteries of the ionosphere and helping hams plan their best use of the bands. Oliver Perry Ferrell began writing our Propagation column in 1946. In 1951, he passed the sunspot torch to George, who shared his tips and predictions every month for the next 50+ years. Tomas Hood, NW7US, took the helm of the propagation column in January 2002, and has continued Perry and George's legacy for the past 18 years. (See George's classic March 1956 article on "Once in a Lifetime Conditions" as we approached the peak of solar cycle 19, the best on record, reproduced in this issue.)

Back Into the Time Machine…

Pardon the distraction of semiconductors, satellites, and sunspots … let's rewind to the early 1950s, when Ameri-

War Surplus Equipment For The Ham

MAJOR M. R. GUTMAN, USAAF (ret.), W2VL

The amount of war surplus radio apparatus (particularly transmitters, receivers and test equipment) which will be made available to the amateur, is unfortunately a debatable question. According to reliable information, much of this material is being "cannibalized"—an army expression meaning deliberately to render unfit for service. CQ is investigating further into the whys and wherefores of this possible situation.

During the past month considerable surplus governmental radio equipment has been placed on the market by the Reconstruction Finance Corp., Several organizations in New York City have been designated as RFC agents and are disposing of surplus radio and electronic equipment. The present policy is to sell transmitting items as radio jobbers. However, returning veterans have been classed as jobbers and may purchase apparatus. Some of the equipment is for sale by radio parts jobbers at very attractive prices. For example, new 9002 UHF tubes have been offered for under $1.00 while they last.

Parts Available

The various agencies of the RFC have many fine parts available to eligible purchasers. Power transformers, audio transformers, variable tuning capacitors, relays, resistors, filter capacitors, G.I. earphones, etc., are available at a fraction of the original cost to the government. However a world of confusion is in order. Much of the equipment has been designed for special services, especially aggressive requirement for AAF use. Transformers designed for an input of from 400/2700 cycles instead of 110 volts 60 cycles a.c. may be had in large quantity. Relays are usually wound

(Continued on page 42)

War surplus equipment purchased by the author at less than cost to the government. The ECO sold for under $10.00

34 CQ

Photo C. The U.S. government released a torrent of surplus radio gear after the war ended, bad news for manufacturers but great for bargain-hunting hams and CQ's bottom line!

Photo D. Solar cycle 19 — the best on record in the radio age — provided amazing DX opportunities in the late 1950s.

Photo E. Most ham gear in the 1950s operated with tubes and the frequency was determined by a crystal.

Photo F. The December 1961 launch of OSCAR-1, the first ham radio satellite, resulted in the shortest-ever CQ editorial!

Photo G. The first great era of ham radio kitbuilding was ushered in by Heathkit in the 1960s. (The second great era is now).

ca's love affair with the automobile and highway travel was shifting into high gear. Ham radio went along for the ride, with mobile operating becoming "a thing," not only for fun and companionship while on the road but because America's love affair with television was heating up at the same time, and with TV came TVI — television interference. TVI was the bane of many hams for decades because the majority of interference problems resulted from poorly designed and filtered TV receivers, and there was often little that a ham could do on the transmit end to resolve the problem. There were plenty of efforts, though, and projects for reducing TVI appeared regularly in the pages of *CQ* in the 1950s and '60s. The problem was eventually solved by the widespread adoption of single sideband (making it harder for the TV owner to identify the source of the interfering signal) as well as the growth in popularity of cable TV, which greatly reduced the susceptibility of still-poorly-filtered TV sets to any sort of "in the air" interference. Today's digital TVs add another degree of separation from ham-related TVI, along with the fact that relatively few people today rely on over-the-air signals for their television programs.

Another staple of the '50s and '60s was crystal control (*Photo E*), as hams commonly had tunable receivers but "rock-bound" transmitters, limited in frequency by the number of different crystals a ham had on hand. This was legally mandated in the case of the Novice license, which was also new on the ham radio scene at the time. In the early 1950s, the FCC did its first of many rounds of license restructuring, changing from the pre-war Class A, B, and C structure to the license classes we know today and introducing both the entry-level Novice Class and experimenter-focused Technician Class. There was also a Conditional Class, with General Class privileges, for hams who were unable to get to an FCC office for testing.

The original Novice license was issued for one year and was non-renewable. Novices were limited to 75 watts of crystal-controlled operation. *CQ* carried the first Novice column of any ham magazine.

The late 1950s saw not only the introduction of transistors to amateur radio, but also the VFO (variable frequency oscillator), the transceiver and single-sideband, which was widely panned by AM traditionalists as "Donald Duck" and "silly sideband." The insults didn't help, though. By the 1970s, SSB was clearly the dominant voice mode on HF, along with FM on VHF.

On the air, DX fever was hot, especially with the cooperation of the sun during Cycle 19. Danny Weil, VP2VB, captivated DXers and *CQ* readers with his 8-year DXpedition aboard the Yasme, as he tried to become the first Englishman to circumnavigate the globe on a solo voyage. His travels extended from 1955 to 1963, and his adventures were chronicled in the pages of *CQ*.

The Cold War spurred rapid technical advances in the 1960s, with hams being both innovators and beneficiaries. The space race between the U.S. and Russia kicked into high gear, and OSCAR-1 became the first non-governmental satellite placed into orbit in December 1961 (*Photo F*). The prior year saw the first amateur radio moonbounce contact, between Massachusetts and California on 1296 Mc. The commercial manufacturers recovered from the glut of surplus gear on the market, and such names as Collins, Hammarlund, Hallicrafters, National, and Drake became the mainstays of many ham shacks. All of this commercially-manufactured gear raised new concerns about hams losing their edge as builders, a vacuum successfully filled by Heathkit, with its reasonably-priced kits and detailed assembly manuals (*Photo G*). DXpeditions continued to make their mark, as globetrotting hams — including Lloyd and Iris Colvin, W6KG and W6QL; and Don Miller, W9WNV (*Photo H*) — made waves from rare DX locations around the world.

On the regulatory front, there was growing concern as the '60s progressed that hams were not keeping up technically and weren't upgrading to higher license classes. This led the ARRL to propose, and the FCC to largely adopt, an *incentive licensing* plan that offered greater operating privileges to hams

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with higher-class licenses. Doing this, though, required the removal of some band privileges from General Class hams, many of whom saw this as a grievous insult and never forgave the ARRL (even to this day).

By the end of the decade, American manufacturers were beginning to struggle, as overseas competitors began making inroads in the overall electronics marketplace. In 1970, Henry Radio introduced Japanese-built gear to the U.S. ham market, featuring an all solid-state receiver — the Kenwood R-599 — and its hybrid tube / transistor twin, the T-599 transmitter (*Photo I*). The U.S. manufacturers were still tied to tube technology and took too long to catch up. The famous names of the 1950s and '60s began to disappear as they were replaced in many ham shacks by Kenwood, Yaesu and ICOM gear. There was still a market for domestically-built accessories, though, and in 1974, Martin F. Jue, K5FLU, started MFJ Enterprises in his home with a CW filter, available pre-built or as a kit. *CQ* celebrated its 25th anniversary in 1970 (*Photo J*) and introduced the first FM column as surplus commercial VHF gear began to become available and the 2-meter FM and repeater era got under way. (That first FM column was reprinted in last month's issue.)

Photo H. DXpeditions were as popular in the '60s as they are now, but usually on a much smaller scale. Don Miller, W9WNV, was among an intrepid group of solo or duo DXpeditioners at the time.

Photo I. As American radio manufacturers struggled, ham gear from Japan began to appear in the 1970s. These Kenwood twins imported by Henry Radio were among the first Japanese rigs in the U.S. ham market.

Into the Computer Age

The last half of the 1970s saw the arrival of the personal computer, and hams were among the first to take advantage of this new age in electronics. Early programs included logging, calculations for complex formulas and — pretty quickly — text-based communications. There were fears that computers would kill off ham radio, but hams simply absorbed the new technology into their stations and developed ways to use it to benefit their operating. Also in the ham shack, separate transmitter / receiver pairs were becoming relics as transceivers became the norm, including such classics as the Yaesu FT-101 (*Photo K*) and the Kenwood TS-520.

In 1979, the World Administrative Radio Conference (WARC-79) ended with international approval for three new HF ham bands — 30, 17, and 12 meters (the so-called WARC bands) — but it took nearly another 10 years for all three bands to be opened for amateur use in the U.S. All of the major contest sponsors agreed informally to make these bands "contest-free zones."

CQ's masthead had some changes at the top as Dick Ross, K2MGA; and Alan Dorhoffer, K2EEK, purchased the magazine from Cowan Publishing. Alan was Editor before and after the change in ownership, and Dick, a previous editor who'd become Associate Publisher, Vice President, and General Manager at Cowan, took the helm as the new Publisher, a position he continues to hold today.

The 1980s saw the continued integration of computer technology into ham radio, not only in our shacks, but in our radios as well. The ICOM IC-2AT (*Photo L*) revolutionized the 2-meter FM handheld market with its frequency synthesizer that allowed users to dial up any frequency on the band, ending reliance on crystal-controlled rigs that limited the number of available frequencies.

Packet radio came on the scene and grew explosively, as hams connected their computers to their radios and created a ham radio internet that preceded the one on which we all live today. Many hams were deeply involved in the development of both in parallel. *CQ* chronicled the growth of packet through both features and the "Packet User's Notebook" column by Buck Rogers, K4ABT, which debuted in 1988.

Ham radio went into orbit with astronaut Owen Garriott, W5LFL (SK), aboard the space shuttle Columbia in 1983, laying the foundation for an ongoing amateur radio presence aboard future shuttle flights, the Russian Mir space station and, today, the International Space Station. The SAREX (Shuttle Amateur Radio EXperiment) MIREX (MIR amateur radio EXperiment) and ARISS (Amateur Radio on the International Space Station) programs have provided thousands of students and others around the world the opportunity to talk via amateur radio with an astronaut or cosmonaut in orbit.

The '80s also saw the launch in 1988 of OSCAR-13, perhaps the most successful high-orbit amateur satellite to date, permitting transcontinental contacts for long periods during the higher portions of its elliptical orbit.

Back on Earth, repeaters were in their heyday, as hams chatted from their cars while traveling to and from work and elsewhere. Autopatch systems linked repeaters to the telephone network, allowing hams to place phone calls via their ham rigs. This led to the FCC's so-called "pizza rule," stating that it was legal for a ham to call a business via autopatch, such as to order a pizza, as long as the ham did not have a financial interest in the business being called. The introduction of the cellphone in 1983 marked the beginning of the end of the need for autopatch, although it took another 10-15 years for cellphone ownership to become ubiquitous.

In 1986, amid growing antenna restrictions imposed on hams by munici-

pal governments, the FCC issued what's known as PRB-1, a limited federal pre-emption of state and local laws prohibiting amateur antennas or making the process of obtaining permission prohibitively expensive. The rule mandated "reasonable accommodation" of amateur antenna needs by local governments, but it did not specify what those accommodations should be, nor did it apply to private land-use ordinances, such as restrictive covenants and homeowner association limitations. The battle to extend the provisions of PRB-1 to those situations continues today.

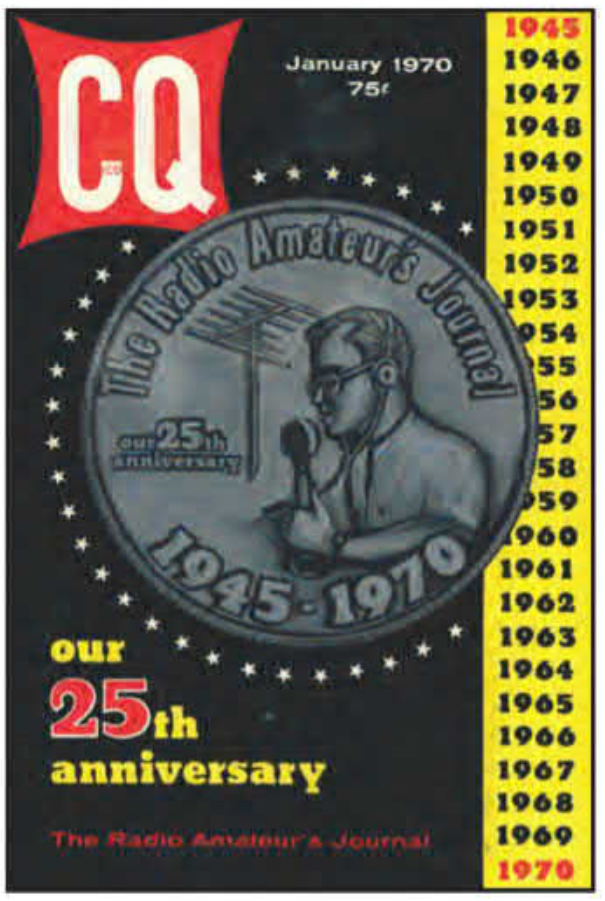


Photo J. CQ celebrated its 25th anniversary in January 1970.

Photo K. Now-iconic HF rigs, such as the Yaesu FT-101 pictured here, and Kenwood's TS-520, were mainstays of the mid-range ham shack in the 1970s and '80s.

The Mixed Blessing of the Internet

The digital revolution gained steam in the 1990s as computers became cheaper and more powerful, cellphones became cheaper and smarter, and the internet linked together what had been standalone computer services (such as AOL and CompuServe) in the 1980s. Email from anyone to anyone became quick and easy. This marked the beginning of the end of the broad popularity of packet radio among hams (although it's making a comeback; see this month's "Digital Connection" column), as messaging speeds over the internet began to eclipse those over the radio. There were fears that easy worldwide communication via the internet would dilute interest in amateur radio, but hams quickly adopted internet technology to help the hobby, with such things as DX Clusters, mobile tracking via APRS, and websites for organizations from local clubs to your favorite ham magazine!

Advancing technology and continuing miniaturization helped pack more features into smaller radios — or a radio into a computer in the case of Kachina (*Photo M*) — and started bringing VHF

and UHF into ham radio's mainstream. ICOM's IC-706, introduced in 1995, featured HF, 6 meters, 2 meters, and 70 centimeters in a single compact package that encouraged hams to operate all bands and all modes from all sort of different places. A few years later, Yaesu's totally portable FT-817, with battery power and an internal antenna, made it easy to go QRP portable on HF, VHF, or UHF. This new portability encouraged various programs intended to get amateurs out of their ham shacks and out to interesting places. Collectively known today as the "OTA" programs, they began with Islands on the Air (IOTA), which started in 1964, but took off in popularity after the Radio Society of Great Britain took over its administration in 1985. IOTA has been followed by Summits on the Air, National Parks on the Air, and similar programs encouraging operation from lighthouses, castles, and more.

Also gaining popularity in the '90s was amateur radio high-altitude ballooning, or ARHAB. This combines satellite technology, digital technology, and fox-hunting (amateur radio direction-finding) skills. These unmanned balloons carrying amateur radio transmitters — and frequently cameras as well — often reach "the edge of space," or roughly 90,000 feet altitude, before bursting and parachuting their payloads back to the ground. The balloon's travel and eventual landing spot are usually tracked by APRS, the Automatic Packet Reporting System, which was developed in the early '90s by Bob Bruninga, WB4APR. Its popularity picked up after Kenwood's TH-D7 handheld (*Photo N*), introduced in 1998, became the first commercially-produced radio to include a TNC and APRS as standard features.

The '90s also saw the beginnings of digital voice in amateur radio, as well as the first world championship of ham radio contesting, the World Radiosport Team Championship (WRTC). In 1991, the FCC made a long-awaited (long-feared by some) decision to drop the Morse code exam requirement for the Technician Class license, then later in the decade permitted hams to choose their own "vanity" calls, subject to certain limitations.

In 1995, *CQ* celebrated its 50th anniversary with a 72-page supplement in the January issue (*Photo O*) and a series of awards and special activities throughout the year.

Photo L. ICOM revolutionized the VHF handheld market with the frequency-synthesized IC-2AT. The hold of crystal-control had finally been broken.

Photo N. Kenwood's TH-D7 was the first commercially-built handheld to include a packet TNC (terminal node controller) and APRS capability as standard features.

Photo M. The first ham rig to fully integrate computers and radios was made by Kachina, which built a radio into a computer. Continued miniaturization has allowed today's gear to have computers built into radios.

Photo O. CQ's 50th anniversary issue in 1995 featured a 72-page supplement, including congratulatory letters from the President and Vice President of the United States and the Chairman of the FCC, among others.

Digital Digs In

The entire technological community entered 2000 with some level of trepidation, as someone had figured out back in the mid-90s that the two-digit calendars built into virtually every computer and related device would roll over on New Year's Eve from December 31, 1999 to January 1, 1900, potentially throwing everything into date disarray. A ton of patches were developed and everyone held their breath as midnight rolled around. Fortunately (and / or because of lots of hard work), "Y2K" came and went without any technological disasters.

On the ham bands, digital and digitized voice moved in with analog, especially on VHF and UHF. Internet-linked repeater networks were set up, such as IRLP and EchoLink. Early in the decade, the Japan Amateur Radio League (JARL) developed the D-STAR

Photo P. The 21st century got off to a roaring start with the launch of Phase 3D — OSCAR-40 — from the European Space Agency's spaceport in South America.

protocol. ICOM adopted D-STAR as its digital protocol and began making both user radios and repeaters that could be linked through a worldwide network. These networks were later joined by Yaesu's WIRES-X and others.

Among digital keyboard modes, while packet continued to fade in popularity, other modes appeared, including PSK-31 on HF (developed by Peter Martinez, G3PLX) and the first iteration of WSJT (by Nobel laureate Joe Taylor, K1JT), which brought weak-signal technology designed for radio astronomy to amateur radio moonbounce (JT4 / JT65) and meteor scatter (JTMS and FSK441). The "JT" modes have gone on to revolutionize ham radio over the past 20 years. During the same time period, K1JT also introduced WSPR, the Weak Signal Propagation Reporter, which — along with the Reverse Beacon Network later in the decade — reshaped the way hams can watch for real-time band openings and see where their signals are being received.

AMSAT launched the long-awaited Phase 3D amateur satellite, planned as a much more capable successor to the very successful OSCAR-13 — and *CQ* ran a live blog during the picture-perfect launch (*Photo P*). Unfortunately, something went wrong after deployment, resulting in an on-board explosion and very short orbital life for what had briefly become AMSAT-OSCAR 40. It also represented the last large-scale cooperation on amateur satellite design and construction between AMSAT groups in the U.S. and other countries — mostly as a result of legislation restricting technology transfer between countries after the terrorist attacks of September 11, 2001.

Ham radio emergency communication once again came to the fore in the immediate aftermath of those attacks (*Photo Q*). New York City's Emergency Operations Center was in the basement of one of the World Trade Center towers that was destroyed and city officials relied on hams to coordinate public safety communications around the city until a temporary EOC could be set up and put in operation. After that, hams continued to provide communications for Red Cross shelters and other facilities set up to help people who were displaced from their homes in lower Manhattan. Hams also played vital roles Shanksville, Pennsylvania and Washington, DC. Ham radio emergency communications continues to play a vital role when hurricanes, floods, wildfires, and manmade disasters knock out normal channels of communication. Hams and their radios continue to get through "when all else fails."

The early 2000s also saw big changes from the FCC, starting with the latest round of license restructuring in 2001. The existing six license classes were reduced to three, with Technician, General, and Extra becoming the only options for new or upgraded licenses (Novice and Advanced Class licenses would no longer be issued, although current licensees could renew and retain existing privileges; the Tech-Plus license was rolled back into the Technician license and all Techs were given Tech-Plus HF privileges, regardless of whether they'd taken a code test). The FCC also greatly expanded the HF phone bands and, in 2007, eliminated Morse code exams for all classes of amateur licenses. Many hams made a point of upgrading before the tests went away, so they could claim they were "know-code" rather than "no-code" hams. In the end, it didn't seem to make a difference, since the ham bands were not overrun by CBers (as some had feared) and many "no-code" hams decided to learn and use the code anyway, for a variety of reasons. Finally on the FCC front, hams gained secondary access to the 60-meter band in 2003, initially being limited to single sideband voice on five discrete channels at 5 MHz. This continues to be the only channelized ham band.

Inside our rigs, surface-mount devices became the norm on the ever-shrinking circuit boards of commercially-built equipment, initially reducing hams' ability to build and repair their own gear (but we've adapted over time!). Frequency displays on most HF rigs became multi-function screens, featuring bandscopes, waterfall displays and more. The decade also saw a renaissance in kit-building, in tandem with the growth of the broader "maker" movement and driven largely by the growing popularity of portable QRP (low-power) radios. *CQ* helped lead the trend with our introduction of KØNEB's monthly Kit-Building column in 2009.

Getting Smaller, Lower, and More Remote

The technological juggernaut ushered in

Photo Q. Ham radio played a vital communications role in the early hours after the terrorist attacks of September 11, 2001 in New York, Pennsylvania, and Washington, DC.

Photo R. Software defined radio is defining the current generation of amateur radio equipment.

by computers and the internet has continued through the decade that ends this year and shows no signs of slowing down. Most of us now have more computing power in our smartphones than in the computers that powered NASA's flights to the moon in the 1960s and '70s. Ham radio has benefitted from all this as well, with the advent of software-defined radios (SDRs) capable of such things as monitoring a whole band at one time or having their operating systems updated by simply downloading a file from the internet. (I remember doing a firmware update a few years back on a radio I was reviewing. The first message on the screen read, "Erasing Radio" and the second read "Downloading Radio" … kinda scary!) While SDRs were "different" from other ham rigs at the beginning of the decade (*Photo R*), the technology has been absorbed by all of the major manufacturers and nearly every new radio sold today is at least partially software-defined.

Another technology that is working its way into nearly everything these days is the use of mircocontrollers, which represent the next step in the progression from transistor to integrated circuit to microprocessor to microcontroller. In addition to being built into many devices (including our radios) to make them "smart," entire devices are being built around such microcontrollers as the Arduino and Raspberry Pi. Hams are hard at work developing programs and projects to put these tools to work in our ham shacks, as described regularly in *CQ*'s "Microcontrollers in Amateur Radio" column.

In addition, our shacks aren't always where our stations are … or maybe it's the other way around, that we aren't always where our stations are, even when we're on the air. This decade has seen significant growth in the popularity of remote operating — either of our own stations or via shared access — generally using internet control links. One reason is that many hams now live in communities with private land use rules that prohibit outdoor antennas. Another is that software and high-speed internet allow us to control and operate our stations from almost anywhere, using smartphones or tablets. There's also the fun of having the opportunity to operate a world-class station, even if it's shared and you aren't physically controlling the radios and antennas.

On the air, the "JT" and "FT" modes have continued to revolutionize operating, with FT8 and FT4 bringing their weak-signal capabilities to the HF bands right at the bottom of the current solar cycle, and allowing hams to keep DXing even when they can't actually hear many signals. We've even got two new bands to play on — 630 and 2200 meters — the first amateur allocations "above 200 meters" since frequency bands were first parceled out nearly a century ago. *CQ* has covered these bands with features and our MF / LF column starting before the bands were even opened for general use.

Hams have continued to build and launch new satellites, often working in tandem with universities that turn over the "birds" to amateur use after concluding their frequently short-term scientific studies. And OSCAR number 100 is the first amateur satellite in geosynchronous orbit, meaning it appears to be in one spot overhead at all times. There were even ham radio transmitters aboard a pair of satellites that went to Mars!

The equipment marketplace is shifting once again as well. Just as American manufacturers faced stiff competition from Japanese companies in the 1970s, the Japanese manufacturers are facing foreign competition today, this time from three sources: American companies are making a comeback, with such manufacturers as Elecraft, FlexRadio, and LDG becoming major players; India has entered the ham market with the introduction of the µBITX line of QRP transceiver kits from HF Signals, and inexpensive radios from China are flooding the lower end of the market. At this point, most of these are VHF / UHF FM rigs, but HF radios are beginning to appear as well, along with computer-integrated test equipment and a variety of low-priced kits. Online ordering and fast overseas shipping are allowing many of these manufacturers to sell direct and bypass U.S. dealers. The downside of that is that purchasers are on their own in terms of questions, returns, and repairs.

What Comes Next?

Hopefully, more sunspots! Expert predictions are trending toward a view that the new Cycle 25 will be of about the same strength (or weakness) as the now-ending Cycle 24. But we're also learning — especially with help from WSPR and the Reverse Beacon Network — that there are band openings even when there aren't any sunspots (just fewer) and we can take advantage of such modes as FT8 and FT4 to keep on DXing with or without help from the sun. Mostly, though, the coming years will provide new opportunities and new challenges that we haven't even thought of yet, just as today's ham radio would be completely mind-boggling to an amateur from 1945. And our up-and-coming generation of new young hams (see the YOTA camp article elsewhere in this issue) will lead the way. Onward to the next 75 years!

Notes:

1. The early history of *CQ* and its predecessors is based on the article "Was There Life Before CQ?" by Bill Orr, W6SAI, in the January 1995 issue of *CQ*. The 50th anniversary issue provided much additional background for this article as well.

2. S. Horzepa, WA1LOU, "Surfin': Emergency Radio Service During 'The War'," ARRL web, 11/5/2010

75th Anniversary Special

CQ CLASSIC

We've been reprinting classic CQ articles over the past several months as our 75th anniversary approached. Now that it's here, we're going to make this issue extra special by loading up on the classics.

We'll start with a feature from the second issue of *CQ*, in February 1945, in which A.C. Matthews, W3FWJ, looks into his crystal ball and predicts the future look of amateur radio as it comes back to life after World War II (which was still in progress as this issue was published). At the end of W3FWJ's article, we'll reprint an article from our 50th anniversary issue in 1995 in which Bryan Bergeron, NU1N, looks into his crystal ball to predict how ham radio might look in 2045. We're halfway there, folks, so let's see how he's doing so far. – *W2VU*

LOOKING INTO THE FUTURE OF AMATEUR RADIO

... while you can't change the ham himself, his post-war equipment and technique will be another case of "something new has been added" . . .

A.C. MATTHEWS, W3FWJ

While it would be rather premature to make definite plans for post-war amateur radio, it is never too early to review the situation as it now stands. At the recent FCC frequency allocation hearings, recommendations were made by ARRL, RTPB and IRAC which are quite favorable to the amateur. Most previously occupied bands are retained (160 meter and 5 meter being questioned), while ad-ditional bands above 400 mc are proposed. Also a new band at 21 mc is being con-sidered which should be welcomed by amateurs interested in DX. All in all, the picture at this time looks extremely promising for the "ham."

No indications have been made, however, to the requirements for occupancy of the new bands. This will, no doubt, be decided when some of the more urgent matters have first received attention; but it's logical to assume the new bands will at first be available to holders of any class license. The chart in *Fig.1* of the proposed allocations show six or seven new bands above 400 mc exclusively for amateur operation. This compares with the pre-war allocation of 18.5 mc. With such a wide expanse of frequencies it might seem that the amateur bands would be sparsely occupied. However, recent surveys have indicated that the amateur population will increase from 60,000 (pre-war) to approximately 250,000 a few years after the conclusion of hostilities. The augmented interest is attributed to the fact that many men and women now in the services have been given radio and electronic training and will welcome the opportunity to incorporate this knowledge into a hobby when they return home. As many of these men and women will be particularly interested in the higher frequencies (since much of their training has been along these lines), there should be plenty of room for everyone for some years to come.

Progress

Much progress has been made in radio since the war began but unfortunately very little can be revealed as yet, due to security reasons. Progress has not been confined to purely technical developments; new processes of manufacture, new materials and new production measuring techniques have been evolved or discovered. All together they represent a tremendous step forward in advancing radio not only as a better public service but also as a more enjoyable hobby. For example the armed forces needed quartz crystals in quantities never before required, with the result that new methods of mass producing crystals with precision accuracy, were developed. This should result in crystals being available at comparatively low prices, well within the reach of all amateurs. Instead of the average station having one or two xtals as in the past, in all probability they will use a dozen or more, not only in transmitters but also for receivers and frequency meters.

Frequency Meters

The frequency meter itself is another point of interest. Pre-war designs left much to be desired, particularly as to long-time stability. However, not long after hostilities began, a frequency meter which fulfilled the most exacting requirements was developed through excellent collaboration between the armed forces and the engineering departments of

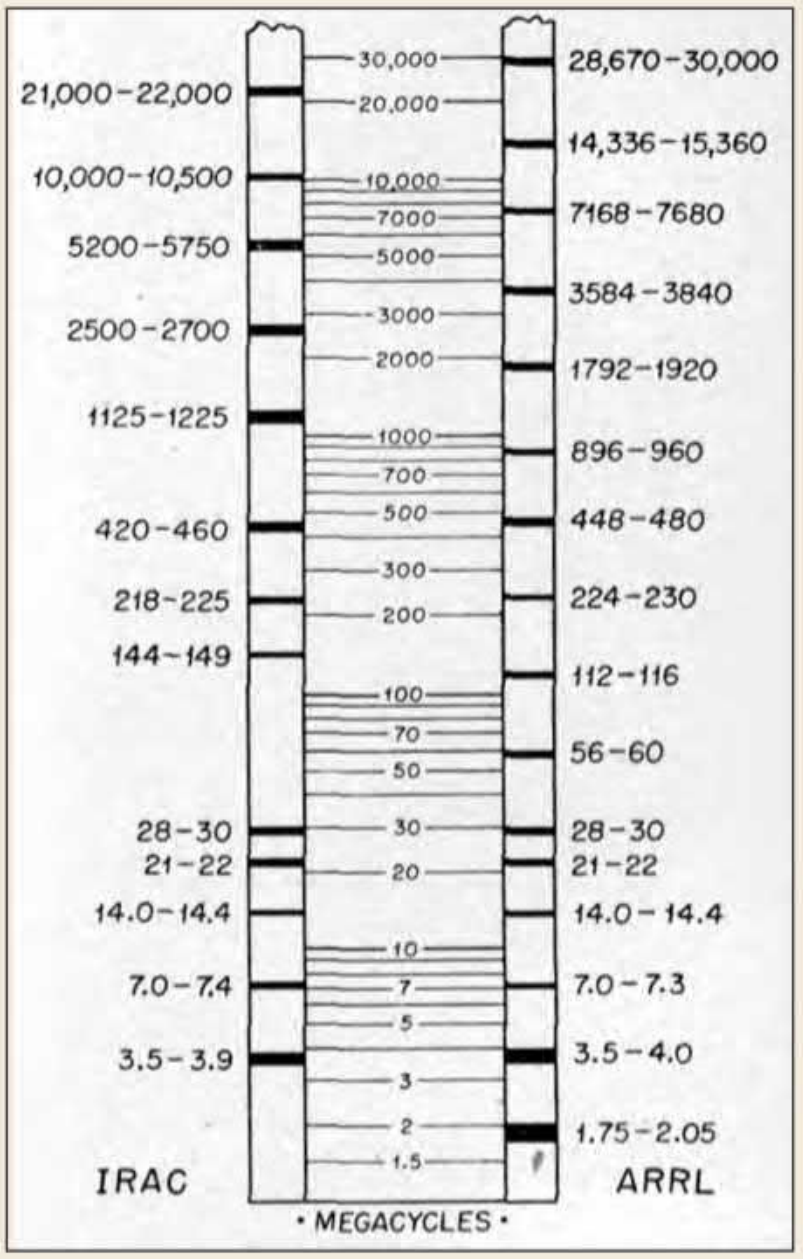


Fig. I. The post-war amateur bands may end up In a compromise between the IRAC and the ARRL recommendations

several manufacturers. From both an engineering and production standpoint, the knowledge and technique gained in the development of a stable frequency meter will undoubtedly result in equivalent instruments being made available to the amateur at a reasonable price.

Medium and UHF Bands

Improvements in medium and UHF amateur band operation will undoubtedly be characterized by more precision gear. The day when most "hams" built their own equipment is past. The future will see the majority of amateur stations equipped with factory-built units. Many of the manufacturers now producing war-time communications equipment will remain in the field and "cash in" on their newly acquired knowledge of radio and electronics. With a larger group of manufacturers producing equipment of this type, competition will push prices down to a level where it will not be worth while "rolling your own," except for experimental purposes.

New tubes which give better value on the amateur yardstick of more watts per dollar have been developed. These tubes, in general, are smaller physically than their pre-war prototypes of equivalent power rating. New techniques in manufacturing have resulted in tubes capable of withstanding severe overloads, a characteristic which the average amateur feels to be of importance since it allows him to "gyp" the circuit in an effort to increase the power output.

Since among our returning GI-Joes there will be many GI-Josephines, the influence of the latter will undoubtedly be evident in the appearance of post-war ham rigs. Much of the equipment will be streamlined, carrying out a trend that was apparent before Pearl Harbor. A 250-watt transmitter in Sheraton, Queen Anne or modernistic design should not

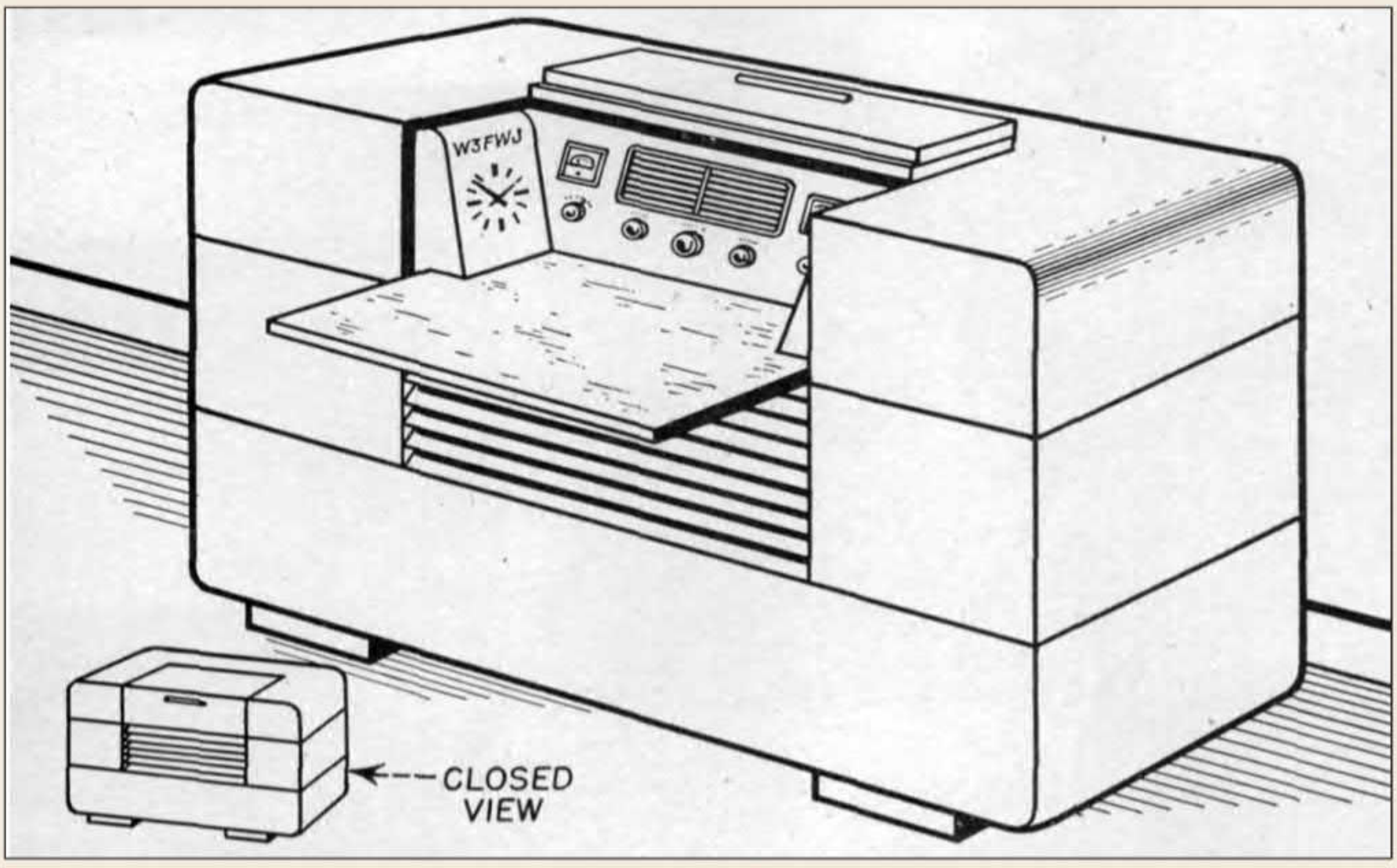


Fig. 2. Transmitter and receiver in a console desk moderne — as the author sees a future ham "rig"

surprise you. It will fit esthetically into the small apartment, and end forever the feminine objections to the mess and "machinery" of "ham" radio.

Reliability and versatility will go hand in hand in the post-war design. This in no small part will be due to the fact manufacturers had to produce equipment according to government specifications. Quality with large production has been the keynote during the war and the lesson will not soon be forgotten.

Television

Pre-war amateur television, like its big brother, commercial television, hardly had a chance to prove itself with only a few amateur stations on the air. Unfortunately, television equipment is extremely complex and requires not only considerable technical knowledge but a large amount of test equipment -to get it "perking." Manufacturers were hesitant to produce a complete unit for amateur use because there was little demand for anything of this nature since commercial television had not yet become a reality.

Here again, new developments and increased public interest, have brought commercial television to the point where immediately following the war, or as soon as materials are available for civilian use, commercial television will be an accepted service. It will then be only a matter of time before commercially built transmitters and receivers will be available for amateur use.

The requirements of the amateur as to picture definition are not nearly as severe as those of the general public because the "ham" is limited to communication between similar amateur stations where close-ups are the usual type of transmission. A 120-line picture should therefore be satisfactory for this service. This simplifies both the receiver and transmitter design, and since the manufacture of cathode ray tubes has been stepped up to a high level during the war, the cost has been greatly reduced. It is probable that a complete station could be sold in the neighborhood of $300.00 if produced in quantities.

Narrow-Band FM

The many advantages of FM for communications purposes are well known. Even prior to the war several police departments used the system for a long enough period to establish its merits for UHF and VHF operation. With the return of amateur activities, narrow-band FM will come into its own especially for UHF use. The simplicity of design, with a minimum of power requirements makes it ideally suited for portable-mobile as well as fixed-station use. While this system of transmission occupies more space in the r-- band (which is likely to be crowded), the reduction of noise, the absence of whistles and tweets, makes its use highly desirable. Ordinarily the station being received will completely block out interfering signals if the desired signal is at least twice as strong as the interfering signal. Another advantage is that, due to lack of noise, the receiver can be operated satisfactorily at full sensitivity under conditions where an AM receiver is often useless. With these advantages it is only natural that the trend in UHF amateur operation should be towards narrow-band FM.

New FM circuits, as yet not fully proven, are being developed. Many more are yet to be invented; so there is plenty

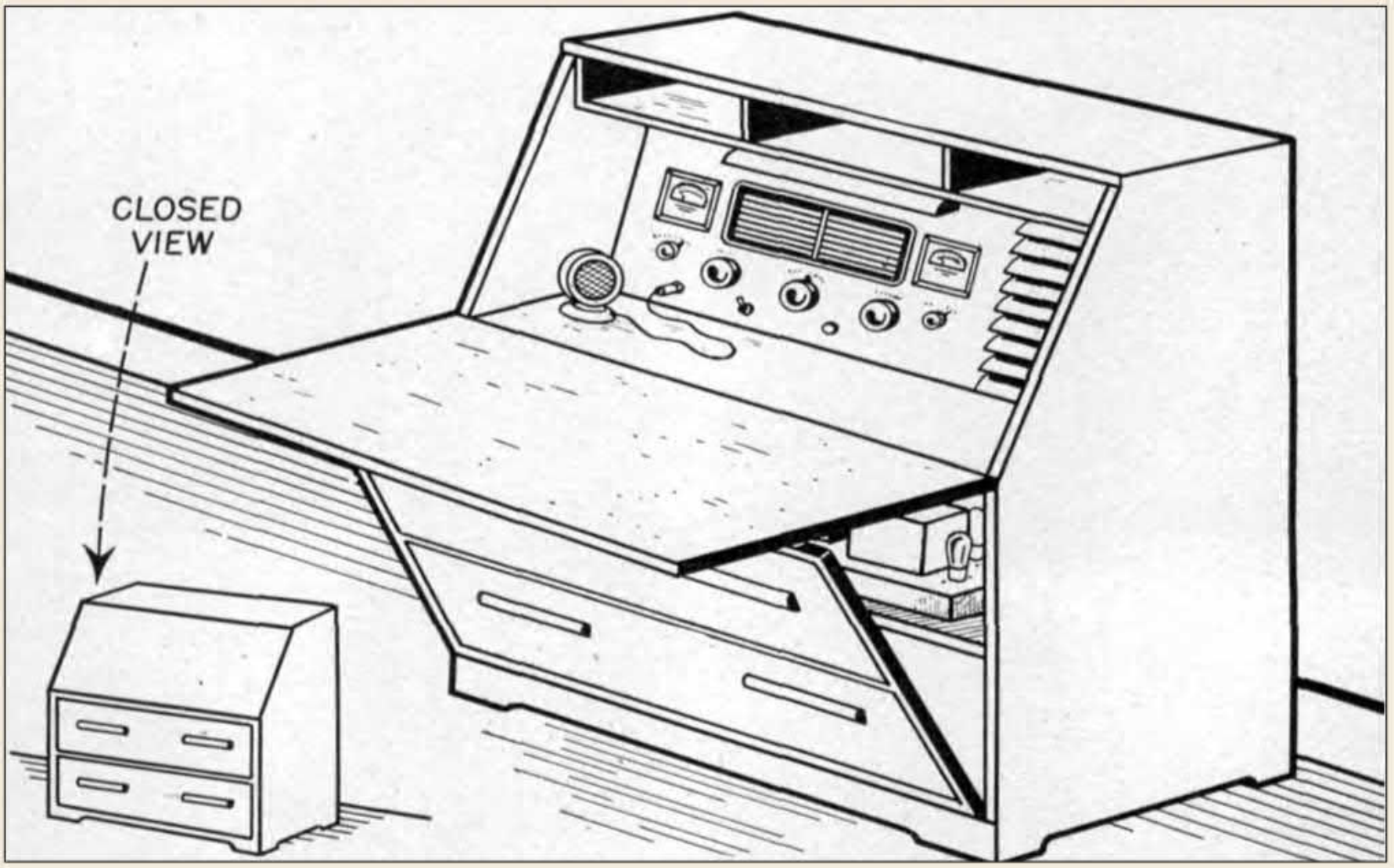


Fig. 3. The secretary-desk layout will fit in well with the rest of the furniture in the average living-room

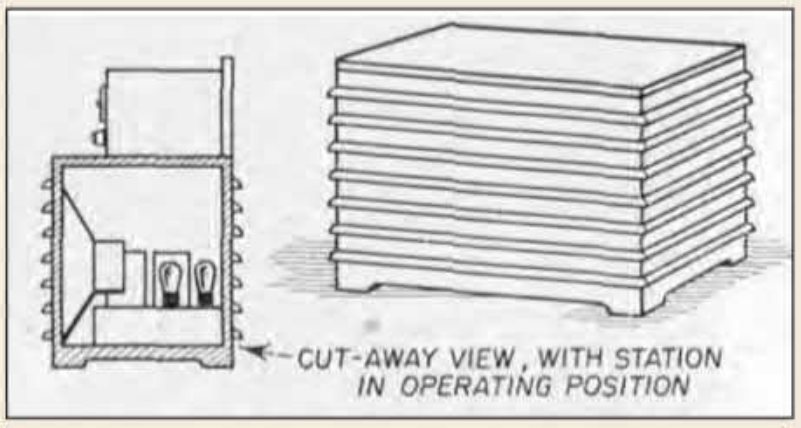


Fig. 4. The end-table type turns modernistic again — and maybe those flanges will radiate a bit of heat from the rectifiers and finals!

of room for both the operating and experimental amateur in the UHF field of narrow-band FM.

Microwaves

The newest, but not the least important, portion of the r-f spectrum is the microwave region. Since recommendations for frequency assignments have been made to the FCC for amateur bands in this region, and the likelihood of their being granted is good, it is desirable to consider some of the possibilities of this region for amateur use.

At present conventional type tubes are available which will operate as high as 1000 mc, and it is likely this limit will be increased slightly in the future. While it is true these tubes have very low power capabilities the fact remains that high or even medium power, as we think of these terms today, is not required for microwave work. Power outputs of less than 1/4 watt can be satisfactorily employed, when advantage is taken of wide band FM with its natural noise reducing qualities, and transmission that is beamed by parabolic or other high gain antenna systems.

So much for the conventional types of tube. Let us now consider tubes designed especially for microwave work such as the Klystron, magnetron and "lighthouse" types. At present such tubes are not available, and if they were, the price would be too high for general amateur use. However, as more experience is gained and production methods are developed, the cost should automatically be reduced to a point where the average ham can afford them.

As for antenna design, it is here the experimental amateur can readily contribute. Antenna installations can be quite varied, from parabolas to cones, horns, stacked dipoles etc. All are capable of enormous gain if designed properly (power gains of 1000 and 2000 being not un-common). Their use is made easier by the fact that the physical dimensions are such that the antennas can conveniently be handled and do not require a backyard for space.

Tuned circuits for microwave operation look like most anything except the familiar coil and condenser combinations of the erlow frequencies. The inductor and capacitor have been replaced by resonant cavities and the transmission line has given way to a "wave guide." Fortunately, new insulating materials have been developed which make the use of transmission lines still feasible at these frequencies with not too great a loss in power transmission. In all probability the amateur will make use of these lines, at least until such time as commercial wave guides are available, since the accuracy with which it is necessary to maintain the physical dimensions of the wave guides makes them nearly impractical for most home constructors.

Amateur Radio: The Next 50 Years

By Bryan P. Bergeron, NU1N

Fifty years ago "state of the art" in amateur radio meant vacuum tubes, discrete components and vernier dials. Sputnik was still a dream, and the transistor hadn't been invented. What amateur in 1945 could even have imagined today's computer-controlled HF rigs, pocket-sized handhelds, packet radio or a fleet of amateur satellites?

Given the incredible evolution that amateur radio has expe-rienced in the past 50 years, what advances can we expect during the next 50? Although it's impossible to accurately predict the discovery of new technologies, it's exciting to explore the limits and promises of known technologies and fantasize somewhat on the role they might have in the metamorphosis of amateur communications.

Through the next decade it's safe to assume that we'll enjoymore compact, lighter, more affordable equipment, with increased functionality, thanks to advances in microproces-sors, ICs and software technologies. Given the enthusiasm surrounding the multimedia services available through the Internet and elsewhere, it's inevitable that RF communications using voice combined with still images and digital video sequences will become the norm. The Dick Tracy wrist communicator, with video and voice communications, perhaps with links to a global positioning (GPS) feature, is inevitable. Of course, the wide-spread interest in video and other high-bandwidth communications, together with more congestion in the VHF bands, should accelerate hams' migration to microwave frequencies and beyond.

Miniaturization and other evolutionary changes in amateur communications, in light of lifestyle trends, will one day make the concept of a “ham shack” obsolete. As an increasingly mobile society, our computers, communications equipment, and other personal tools must move with us to be useful. Even today there are many amateurs who can't find the time to work HF DX but can manage to exchange greetings via two meter handhelds and work with their laptop computers on their daily commute. Similarly, the workbench of the future is likely to take the form of a desktop computer that allows the user to exper-iment with various digital signal processing (DSP) algorithms. Why work with a soldering iron when you can use software to design and customize any electronic communications device you might want?

Looking ahead 20 or 30 years, given the current rate of change, the very nature of our personal communications will be quite different from the current exchange of verbal or coded greetings. Research in telepresence and virtual reality will ultimately yield technologies that will allow us to personally visit our contacts, using remotely controlled robots with steerable cameras and tactile sensors, plus data gloves with tactile feed back. We'll be able to look at, see and even touch our contact's rig, take a look around the room, move to a window and look out at the weather and perhaps even get a sense of his or her neighborhood. A DX contact will come to mean much more than a QSL card from a distant ham. Through virtual reality each station operator will be able to visit a foreign land and experience the environment first-hand.

Looking further into the future, and borrowing from a few pop-ular science-fiction movies, one could envision being able to communicate our objective experiences through virtual reality body suits. That is, the sights, sounds, temperature and tactile sensations experienced by the wearer of one suit could be transmitted to the wearer of another. Imagine “tuning” the bands and joining an amateur sailing the Mediterranean, hiking in the Rockies or driving through Germany. What about peering through OSCAR 99's onboard camera system, directing the view with a turn of your head or a twist of your hand? Or experiencing a view from the perspective of an amateur-astronaut standing on the observation deck of a future space station?

The bandwidth requirements for sending all of this data would be incomprehensible to today's amateurs. Just as we look back in disbelief at the original PCs being useful with only 64K of memory, we will one day wonder how anyone could possibly make due with less than 100 MB of bandwidth. Part of the bandwidth solution will undoubtedly come from new data compression algorithms, together with alternative communications media, such as networks of communications satellites.

Extrapolating the achievements in molecular genetics, an amateur radio 50 years in the future may be more reliant on biologic mechanisms than on conventional silicon-based electronics. By the year 2045 biomedical implants, synthesized with the help of human-engineered DNA, may make virtual reality body suits and other external signal transducers unnecessary. Through these biological implants, we'll be able to experience a selective telepathy of sorts, communicating our conscious thoughts and emotions. After all, isn't this the ultimate form of personal communications?

Of course, this is just one amateur's perspective. What the future holds ultimately depends on our collective willingness to push the envelope of personal communications to new hori-zons. What horizons do you see in our future?

75th Anniversary Special

CQ CLASSIC

One of *CQ*'s strongest suits has always been its propagation column and its propagation columnists — we've only had three of them in 75 years! Our propagation editors have taken the sometimes arcane science of ionospheric physics and explained in plain language how to best take advantage of the DX opportunities that the ionosphere presents. *CQ*'s early readers even participated in a government-sponsored propagation study.

The late 1950s coincided with the rising years of solar cycle 19, with the highest-ever recorded number of sunspots and propagation conditions that have so far been unique in the radio age. *CQ* was there to help its readers make the most of the "Once in a Lifetime Conditions." This article by then-Propagation Editor George Jacobs, W3ASK, appeared in the March 1956 issue. – *W2VU*

Once in a Lifetime Conditions

by George Jacobs, W3ASK
Propagation Editior, CQ

The Sunspot Story: Cycle 19

The Swiss Federal Solar Observatory has recently announced that the new sunspot cycle, which began during April, 1954, will reach a maximum during the middle of 1957 and will be one of oustanding intensity, with the maximum likely to surpass all others hitherto observed. Because of the direct correlation between sunspot activity and ionospheric characteristics, shortwave radio conditions during the next few years may be *better than they have ever been in the history of radio* . . . with the possibility of world-wide DX on Six Meters, around the clock DX on Twenty Meters, direct reception of European and Latin American TV transmissions and other shortwave transmission conditions that occur at best only once in a decade and possibly only once in a lifetime!!

Because sunspots and accompanying solar radiation play such an important factor inshortwave radio communication, an up to date summary of the possible effects of this unprecedented rise in sunspot activity is in order. Consequently CQ has asked its Propagation Editor, George Jacobs, W3ASK, to review the influence of the sun upon the ionosphere and from this viewpoint to discuss the shortwave propagation outlook for the next few years. The discussion is presented in two parts. Part One reviews the origin of sunspots, the effects of solar radiation upon the ionosphere as well as a discussion of the present sunspot cycle trend and a forecast of solar activity expected over the next several years. Part Two, appearing next month, will discuss the rapid rise in sunspot activity in relation to shortwave propagation conditions on the high frequency amateur bands and in the VHF range. The possibility of long distance TV reception and other shortwave transmission conditions will also be discussed.

PART ONE

Sunspot Origin

The exact nature of sunspots, what they are and what causes them, is still rather obscure. Within the past thirty years however, scientific investigations have found that these

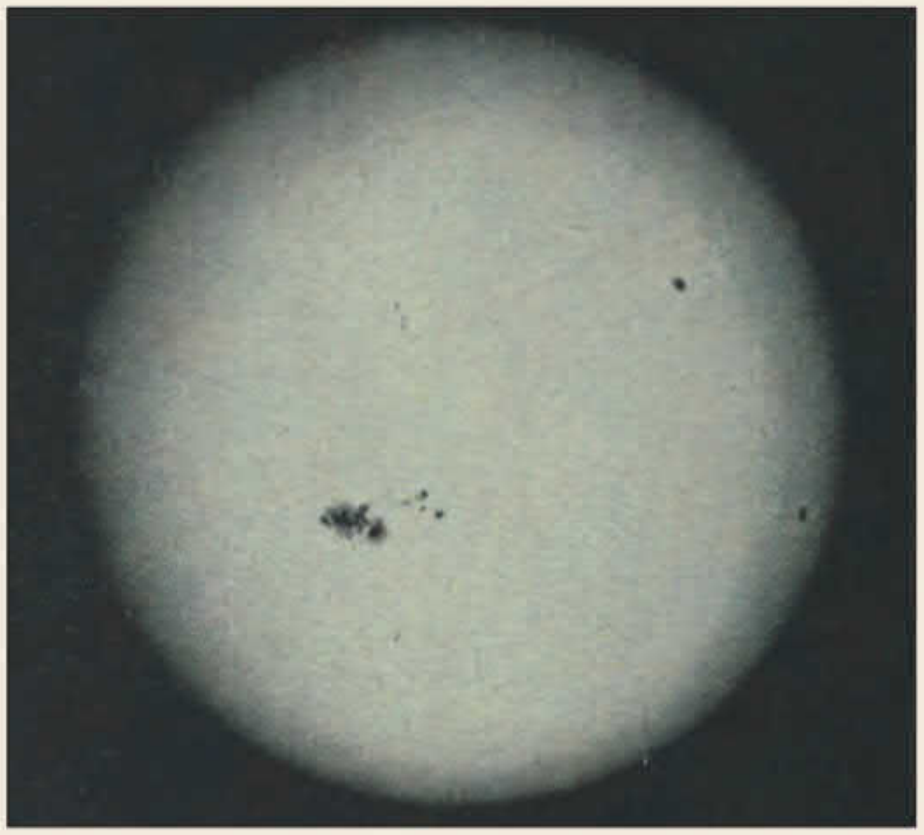


Fig. 1. Large sunspot group on the face of the sun. (U.S. Navy Photo)

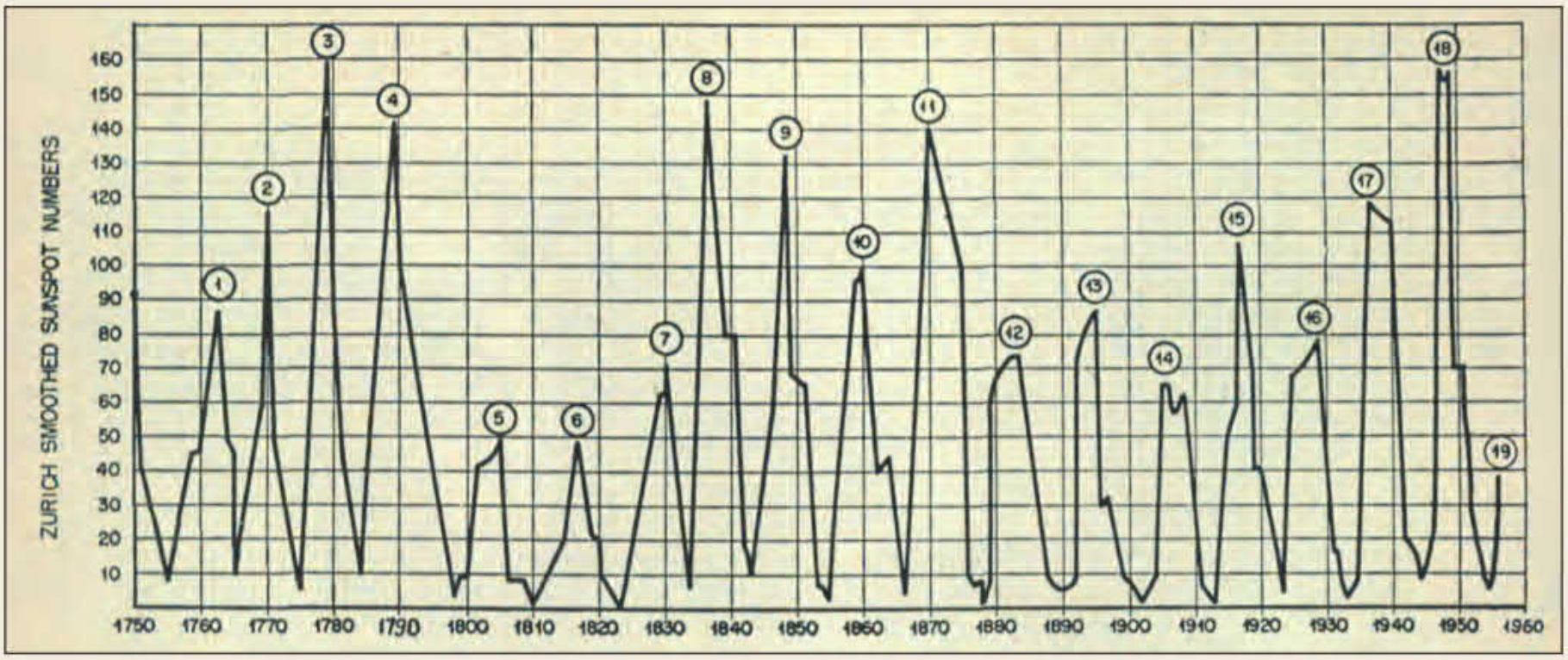


Fig. 2. Sunspot cycles since first observation in 1750 A.D.

blemishes on the face of the sun have a direct influence on shortwave radio conditions. *Figure 1* is a recent photograph of the sun taken at the U.S. Naval Observatory, Washington, D.C. The sunspots appear as black spots across the sun's surface. They are believed to be temporary craters caused by violent explosions taking place from time to time on the sun. Sunspots almost always appear in groups. The groups range in visual size from small specks to rather large areas. Sunspots are sometimes large enough to see with the naked eye, provided that a piece of smoked glass or some other type of ray filter is used to protect the eyes from the direct rays of the sun.

The actual size of large sunspots range between *50,000* and *150,000* miles in diameter, an area into which several planets the size of the earth would easily disappear. Even most smaller spots have diameters larger than that of the earth.

Sunspots are known to have been observed by the Chinese as far back as 28 B.C. Long before present day scientists associated these spots with violent disturbances on the sun, they were observed to come and go with a certain degree of regularity. Daily recorded observations of the sun were first undertaken during the 18th century, following the invention of the telescope, and an unbroken accurate record is available from 1749 to the present. Daily observations of the sun are now made at several solar observatories throughout the world. The Swiss Federal Observatory at Zurich is responsible for collecting this data and determining an index of solar activity, frequently called the "Zurich Sunspot Number." These sunspot numbers are given as daily, monthly and 12-month running average values. The daily number takes into account the number of individual sunspot groups on the sun's disk and also the number of individual spots counted within the groups. This result is multiplied by a factor to take into account the power of the telescope used for viewing the sun. The daily sunspot number is subject to considerable day to day variation and has little direct correlation with general shortwave radio conditions. To obtain a true long-term trend, not colored by the short-period fluctuations, monthly averages of the daily sunspot numbers are reduced to a 12-month running average or smoothed sunspot number. The smoothed sunspot number is calculated monthly and takes into account the Zurich monthly numbers for a one year period. It is this monthly value of *smoothed sunspot number* that exhibits the trend that develops into the so called 11-year cycle of the sun.

Figure 2 is a plot of all sunspot cycles recorded since 1750. It can be seen that sunspot activity varies from year to year, but does so in a periodic manner to produce alternate minima and maxima at intervals of several years. The number of years for a complete cycle of activity, from minimum, through maximum, and back to minimum again, varies somewhat with each cycle, but has an average period of approximately 11 years and for this reason it is usually referred to as the *11-year sunspot cycle*. It should be noted however that no two cycles are exactly the same and that some cycles have been as short as nine years and others as long as 14 years in duration. The last previous complete cycle, cycle 18, was a ten year cycle which began in early 1944 and ended in April, 1954. It was the highest cycle recorded since 1778. The present cycle, the 19th observed since 1750, began during April, 1954.

In 1908, Dr. George Hale of the Mount Wilson Observatory in California, demonstrated that sunspots were giant cyclones or whirlpools in the sun's atmosphere. This dis-covery led to the present day conception of sunspots as terrific storm centers on the sun covering billions of square miles. There is also more recent evidence that these storms are similar to, but probably millions of times more violent than, explosions of the type associated with thermonuclear devices.

Another very important discovery concerning sunspots came from Mount Wilson Observatory at about the same time when it was found that sunspots are the center of intense magnetic fields. The magnetic fields associated with some type of sunspots have been measured to be many times as powerful as the magnetic field surrounding the earth, and

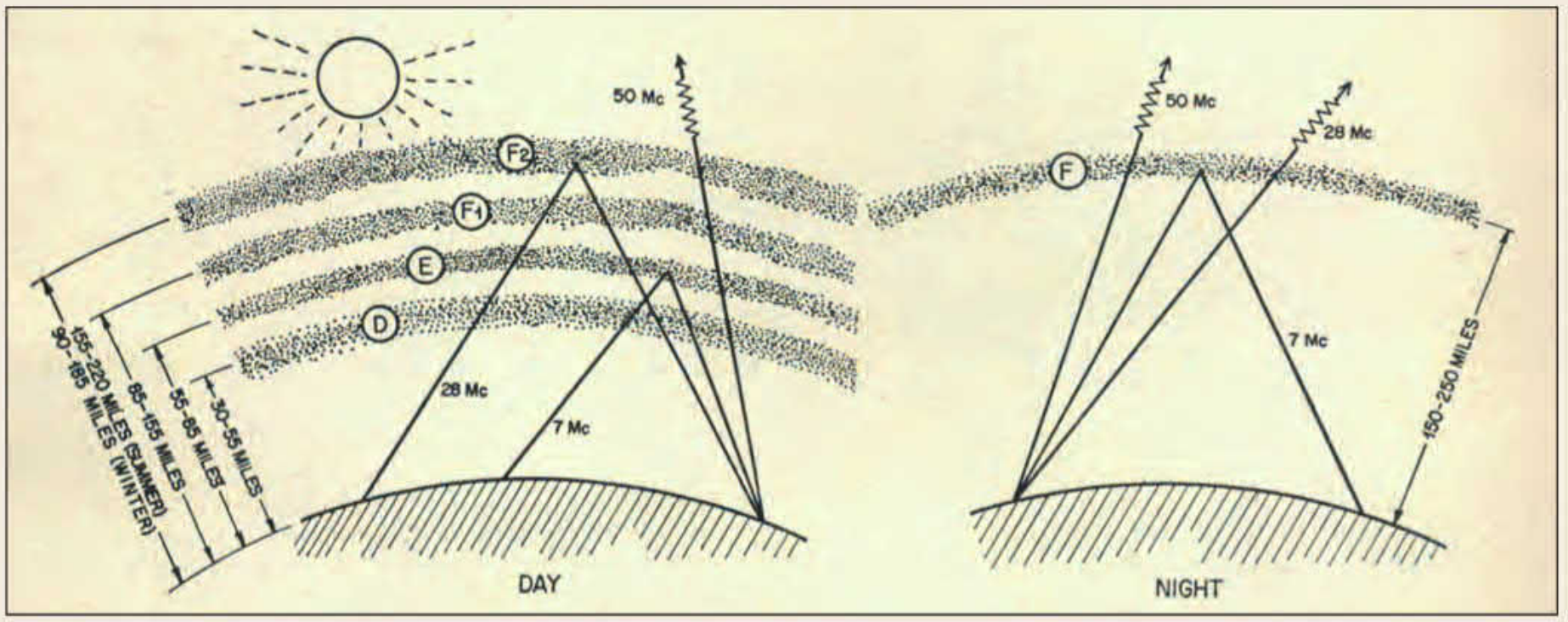


Fig. 3. Ionospheric layers and radio propagation.

quite often the occurrence of large sunspot groups will result in violent fluctuations in the earth's magnetic field.

From the radio communication viewpoint, perhaps the greatest discovery concerning sunspots was made during the late 1920's when Dr. Edison Pettit and his associates at the Mount Wilson Observatory found that a direct relationship exists between sunspot activity and the amount of ultraviolet energy radiated from the sun, with the sun emitting greater amounts of ultraviolet radiation during the maximum of a sunspot cycle than during the period of minimum sunspot activity.

While the cause and exact nature of sunspots are still unknown, there is at present scientific evidence that they are associated with violent eruptions on the face of the sun, that they possess strong magnetic fields and are in some way related to the degree of electromagnetic energy radiated from the sun in the form of ultraviolet light and that they occur in a long-term cyclic manner. We shall see shortly how these characteristics have a direct bearing on shortwave radio propagation conditions.

The Ionosphere

Prior to 1901, it was the general belief that radio waves were restricted to line of sight paths and that a signal traveling beyond the horizon would continue in a straight line through the atmosphere and be lost in space. In 1901, when Marconi successfully spanned a 2000 mile path over the North Atlantic with a radio signal, the theory of that day was questioned. In 1902, in an attempt to explain Marconi's long distance transmission, Arthur Kennelly in the U.S. and Oliver Heaviside in England independently theorized that some agency must exist capable of assisting radio waves beyond the horizon and preventing them from flying off uselessly into space. They suggested that this agency must be an electrically conducting layer in the upper regions of the atmosphere and that it was this conducting layer, or *ether* as it has been referred to, that was guiding radio signals around the curve of the earth. But the theories of Kennelly and Heaviside were to remain as theories for many more y e a r s ... years during which the art of radio communication underwent tremendous expansion and development. It was not until a quarter of a century afterward that the first experiments *verifying* the existence of an electrically conducting layer were actually made.

In late 1924, Edward Appleton (later knighted for his discovery) and his co-workers in England found important direct evidence that an elecrically conducting layer exists in the upper atmosphere when they performed measurements which indicated that radio waves from a distant station came

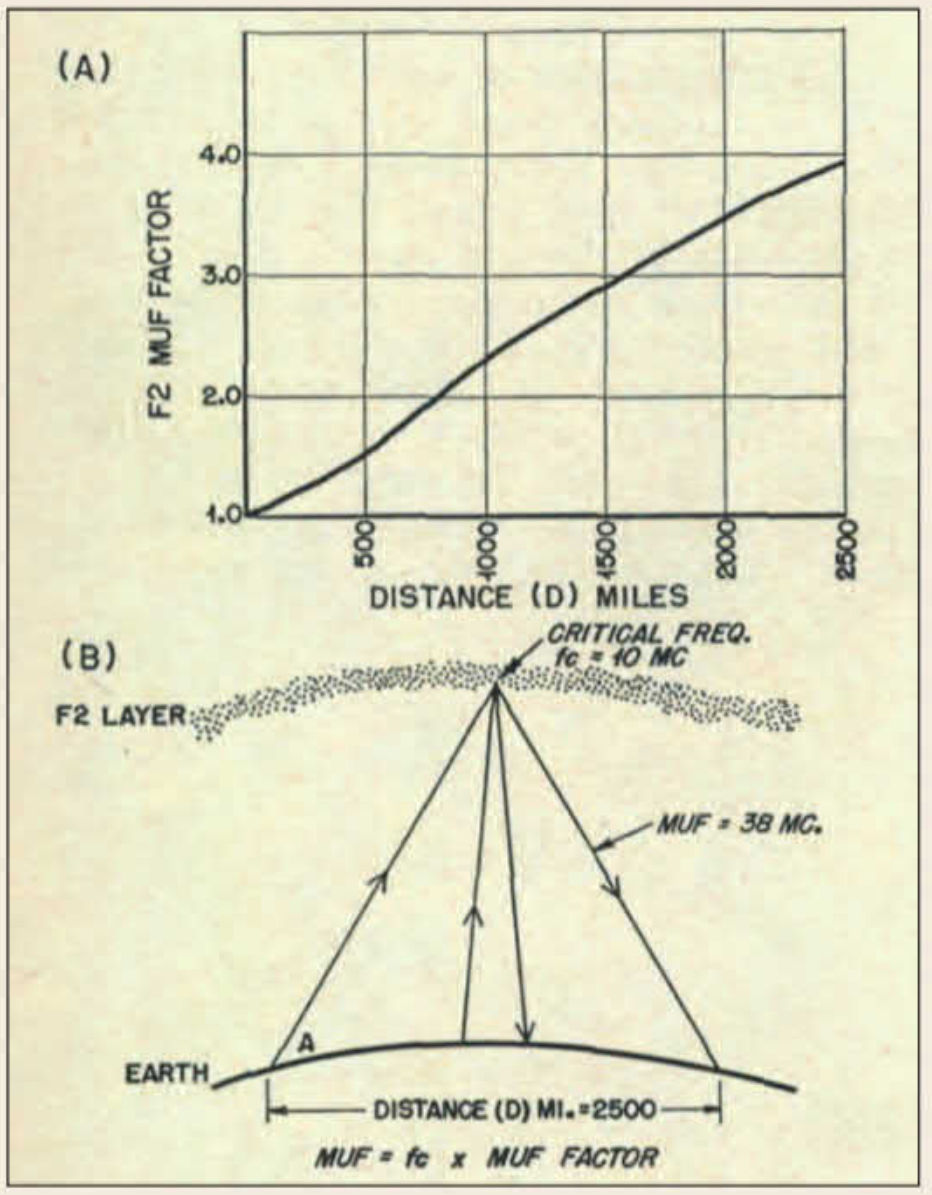


Fig. 4. MUF Factor Relationship between critical frequency and MUF.

down at an angle from the sky. A few months later they identified and located this electrically conducting region to be about sixty miles above the ground. The name ionosphere was given to this region and has been universally adopted.

In 1925, two American physicists, Breit and Tuve, performed an historic experiment concerning the ionosphere. They transmitted short pulses of radio waves straight up into the atmosphere and caught the echos of these pulses, reflected from the ionosphere. Both the direct pulse and the reflected echo were recorded on an oscillograph, and by timing the delay between them they were able to measure the height of the reflecting region and later to determine the degree of conductivity, or reflection characteristics of the ionosphere. It is the method developed by Breit and Tuve that has made it possible to study the ionosphere on a world-wide basis.

By 1925 there was no longer any doubt that long distance radio communication is possible only because of the existence of the ionosphere and that it is the ionosphere that acts as a mirror, reflecting high frequency or shortwave radio signals over great distances. The range of frequencies between 3 and 30 Mc. are most easily reflected by the ionosphere, but at times frequencies considerably lower are reflected and at other times reflection has been known to occasionally occur on frequencies as high as 100 Mc. and possibly higher.

Dr. Pettit's discoveries, discussed previously, indicated that ultraviolet radiation from the sun may be responsible for the formation of the ionosphere. This was further confirmed during the eclipse of 1927. It was observed that during the minutes of total eclipse, when all radiation from the sun was cut off from reaching the earth by the moon, the degree of ionization of the ionosphere decreased considerably, with almost the complete region disappearing. This coincidence implied that solar ultra-violet radiation was truly the principal factor in the production of the ionosphere. Observations at subsequent eclipses have further verified this fact.

The higher regions of the earth's atmosphere are composed of various gases, mainly oxygen, nitrogen, hydrogen and helium. The ionosphere is believed to be formed by the ultraviolet radiation from the sun sweeping across this region and causing the gases to break up into little bits of charged electricity. This process is called ionization, and the ionosphere consists of several cloudlike, charged layers formed by the ionized gases. *Figure 3* shows these layers as they exist at various heights above the suface of the earth. During the daytime the lowest layer is the D-layer, followed by the E-layer, then the F-l and F-2 layers in ascending order. During the night, or hours of darkness, when the sun is not illuminating the ionosphere, all the layers with the exception of the F-2 layer generally disappear. The heights of the layers vary with changing conditions in the ionosphere, with the complete region generally lying between 30 and 250 miles above the earth. Typical layer heights are shown in *Figure 3*.

When a radio wave reaches the layers of the ionosphere, it will either penetrate the ionosphere and be lost in space or it may be returned to earth by a bending process called refraction, depending upon the frequency of the radio wave, the angle at which it strikes the ionosphere and the degree of ionization of the layers. *Strongly ionized layers reflect higher*

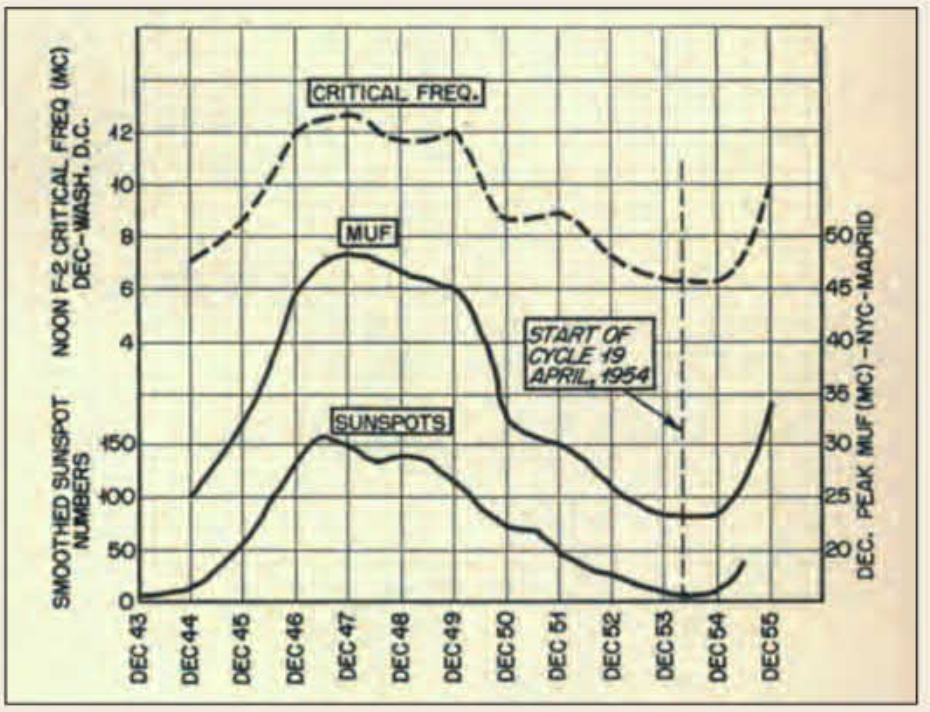


Fig. 5. relationship between smoothed sunspot numbers, critical frequencies and MUF's 1944-1945.

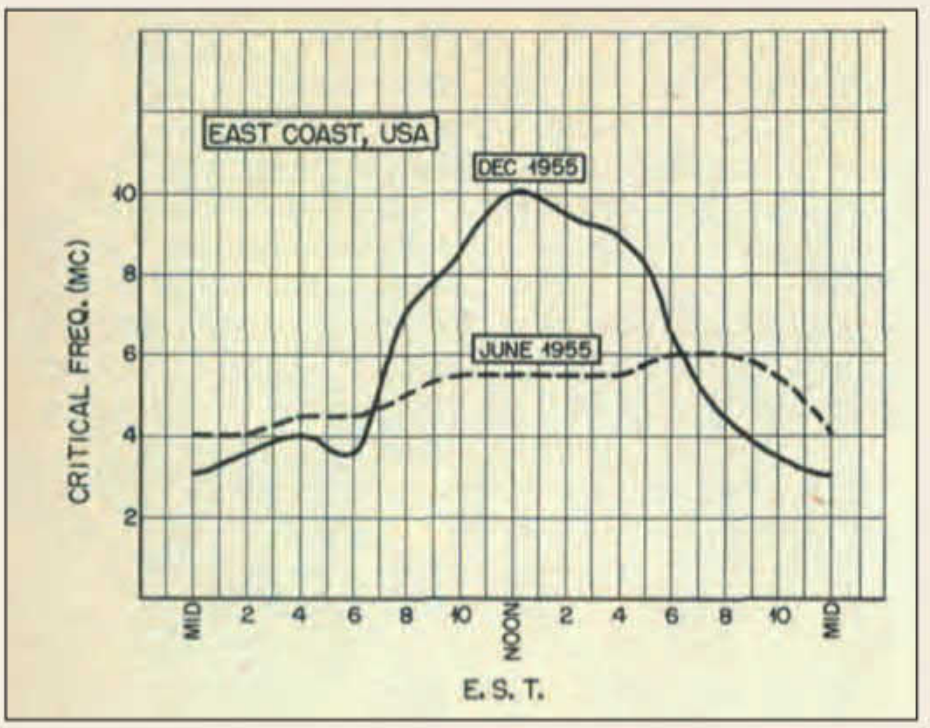


Fig. 6. Hourly and seasonal variations in the ionosphere.

frequencies than will weakly ionized layers. Throughout this discussion we shall use the terms refraction and reflection interchangeably to describe the action of the ionosphere upon a radio wave.

Ultraviolet radiation from the sun has been mentioned previously as the principal ionizing source producing the ionosphere. We have seen that the smoothed sunspot number is a fairly reliable index of the degree of ultraviolet radiation from the sun. When the sunspot numbers are high, considerable ultraviolet energy will be radiated and the layers of the ionosphere will consequently be strongly ionized. This will permit the reflection of higher frequencies than is possible during periods when the sunspot numbers are low and the layers are weakly ionized. The relationship that exists between sunspot numbers, the ionosphere and shortwave propagation conditions should now be fairly evident.

Ionospheric Measurements

Utilizing the technique of probing the ionosphere developed by Breit and Tuve, and mentioned previously, it is pos-

sible to send pulsed waves vertically upwards towards the ionosphere and observe the time it takes for the echo or reflected pulse to return to earth. The instrument used to explore the ionosphere in such a manner is called an ionosonde. With the ionosonde it is possible to determine the height at which reflection takes place as well as the degree to which the various layers are ionized. The degree of ionization is determined by sweeping across a large range of frequencies and observing the frequency that first penetrates the ionosphere, for which there is no return echo. The *highest* frequency at which a signal transmitted vertically upwards is returned to earth is known as the *critical frequency* for that layer. The critical frequency can be directly related to the electronic content of the ionosphere. The height of the ionosphere is determined by measuring the time difference between the direct pulse and echo, and multiplying this time by the velocity of the wave.

Changes within the ionosphere can be detected by changes in the critical frequency. These changes indicate increases or decreases in the degree of ionization. As we shall see shortly, the degree of ionization is greater during the daytime than at night, but may be smaller in the summer than in winter. It increases with increasing sunspot activity throughout the 11-year cycle, and also varies geographically. At present, the critical frequency of the various layers is measured at least hourly at nearly 100 ionosonde stations throughout the world. In this way the characteristics of the ionosphere are observed continuously on a world-wide basis.

Maximum Usable Frequency

Radio waves transmitted vertically into the ionosphere are returned to earth as long as their frequency is equal to, or less than, the critical frequency of the layers which they strike. Such a signal returns to earth close to the transmitting station and therefore has very little communication use. To transverse the large distances required for world-wide radio communications the signal must leave the earth and enter the ionosphere at an oblique or slant angle, the exact value of which depends upon the height of the reflecting layer and the length of the transmission path. The *highest* frequency that can be used on an oblique transmission path is called the *maximum usable frequency*, *or MUF*. Frequencies above the MUF will either be lost in space, or returned to earth at a more distant point than desired. The MUF also represents the frequency at which absorption is near minimum, and signal strength strongest. While frequencies excessively below the MUF will be reflected from the ionosphere, they are generally unsatisfactory because of high absorption and noise.

There is a direct relationship between the critical frequency, which actually can be considered the MUF for a path of zero distance, and the MUF for a path of any distance. The exact relationship is somewhat complex and will be touched upon only briefly here. The MUF for any distance is greater than the critical frequency at the point the signal enters the ionosphere by a factor called the *MUF factor*. The MUF factor is determined from the trigonometric relationship that exists between the height of the inosphere, the path length, and the vertical radiation angle of the wave as it leaves the antenna. The MUF factor has a value of 1 at zero distance, the critical frequency, and reaches a maximum value of 4 for the F-2 layer at transmission distances greater than 2500 miles. *Figure 4* shows a typical MUF factor curve and its application.

It should be noted at this point that the amount of power radiated does not enter into the determination of the MUF. The ionosphere either returns or does not return a radio wave depending entirely upon the frequency of the wave and the degree of ionization, and is not dependent upon the power radiated. This applies to the normal case of a truly reflected wave and does not apply to the case of "scatter" reflections from the ionosphere that may occur under certain abnormal conditions, or when powers on the order of hundreds of kilowatts are radiated. Under these last two conditions, radiated power may at times enter into the determination of the MUF, but these are conditions that are not generally encountered in amateur type communications.

Ionospheric Variations

The ionosphere exists primarily because of the ultraviolet radiation of the sun. Responding sensitively to this radiation, the ionosphere behaves like the restless sea. It changes from hour to hour, day to day and season to season coincidental with variations in the strength of the sun's radiations. These variations can be studied and detected by changes in the measured value of critical frequency. Several variations are periodic and we can anticipate their effects.

Since it is the F-2 layer that is of primary importance to long distance and amateur type communications, the discussion of ionospheric variations will be more or less limited to those that occur within the F-2 layer. Similar variations are however also observed in the E and F-l layers.

We have previously discussed the 11-year cycle variation in the ultraviolet radiation from the sun. We would therefore expect to find a similar variation in the characteristics of the ionosphere. From *Figure 5* it is evident that such a variation exists. The F-2 layer critical frequency follows

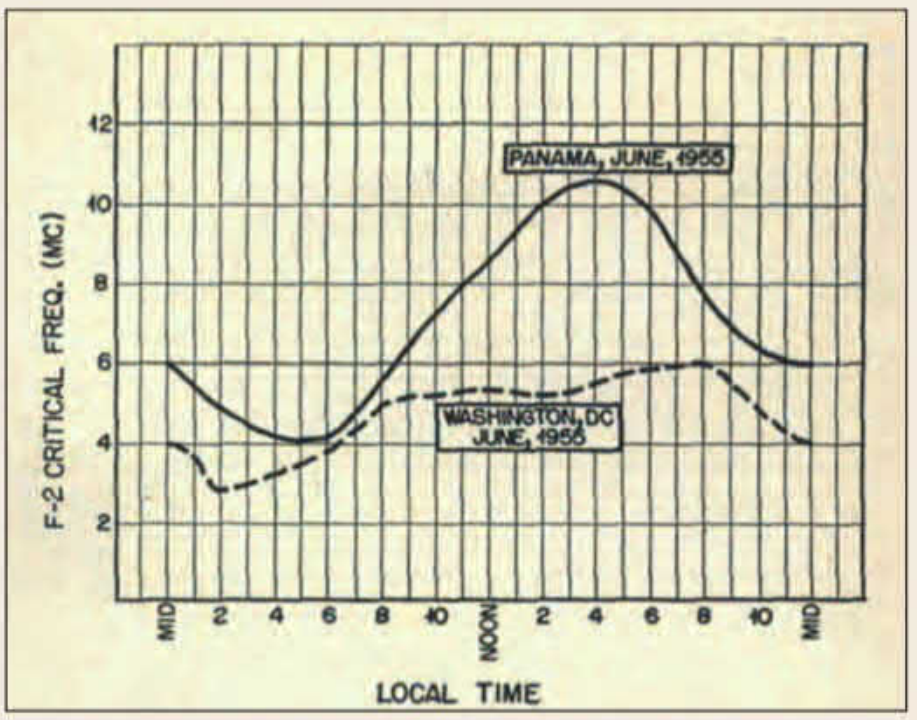


Fig. 7. Geographical variation in the ionosphere.

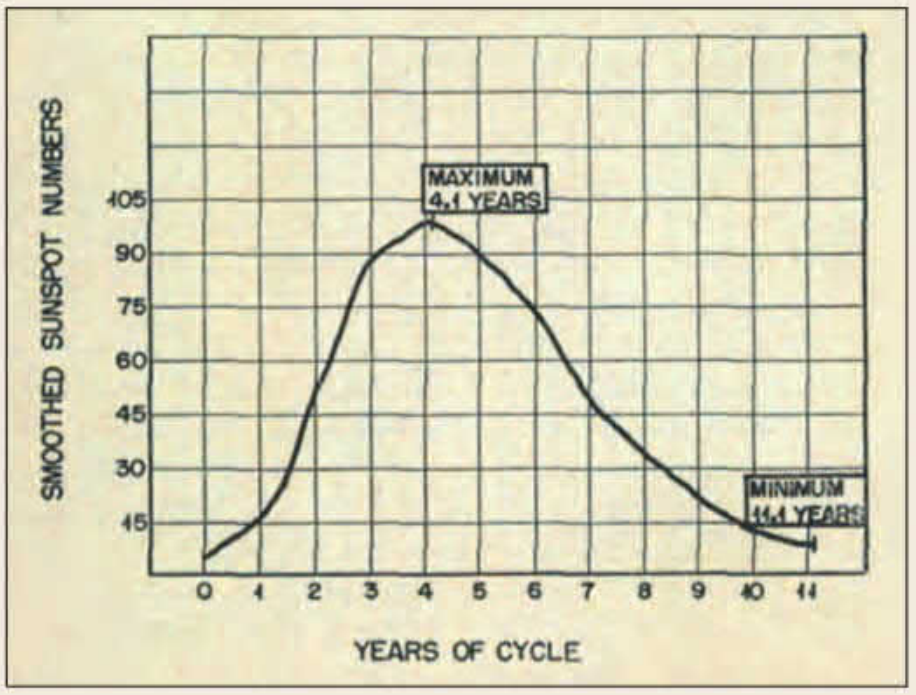


Fig. 8. Mean values of cycles 8-18

closely the sunspot variation throughout the sunspot cycle, varying between 5.5 and 12 Mc. from minimum to maximum. The peak value of December MUF on an actual circuit, in this case NYC to Madrid, follows a similar variation with the MUF being 24 Mc. at sunspot minimum and 49 Mc. at maximum. It can be seen that values of reflected frequencies during the period of maximum sunspot activity were *more than twice* as high as those reflected during the minimum of the cycle.

Besides the 11-year variation in the ionosphere, the sun's ultraviolet radiation illuminating the earth's upper atmosphere at any particular time varies in accordance with the changing angular relationship between the sun and the earth. This results in hourly, seasonal and geographical variations in the characteristics of the ionosphere.

The *hourly variation* is caused by the twenty-four hour rotation of the earth about its axis. This rotation not only produces a variation in the intensity of sunlight resulting in night and day, but also causes a corresponding variation in the intensity of ultraviolet radiation reaching the layers of the ionosphere at any specific point above the earth. During the daytime hours, when ultraviolet radiation is strongest, the ionosphere is strongly ionized and relatively high frequencies are reflected back to earth. During the hours of darkness, very little radiation reaches the ionosphere from the sun, and the region decreases to a single weakly ionized layer. If we were to use the same frequency for night time transmission that we use in the daytime, we would find that the signal would penetrate the weakly ionized night time layer and would not be reflected back to earth. Consequently, night time values of reflected frequencies are lower than daytime values. This can be seen from *Figure 6* where the hourly changes in critical frequency are shown. Daytime values range between 5 and 10 Mc, night time values between 2.5 and 5 Mc.

Figure 6 also indicates the *seasonal variation* that takes place in the ionosphere. Throughout the year the earth is traveling in a fixed path about the sun called the ecliptic. This celestial journey accounts for the various seasons and the varying lengths of day and night throughout the year. During the winter months the earth is *closer* to the sun than during the summer months, the distance between both planets being 91.5 million miles in winter and 94.5 million miles in summer. Ultraviolet radiation during the winter daytime period is more intense, resulting in the reflection of higher frequencies, than during the summer months. On the other hand, the longest periods of darkness occur during the winter months. This permits the ionosphere more time to lose its electrical charge, or to deionize, and become weaker. Reflected frequencies during the winter night-time period are considerably lower than during the summer months. Taking into account both the hourly and seasonal variations, from *Figure 6* it can be seen that the *highest* value of reflected frequencies, indicating the greatest degree of ionization of the F-2 layer, will occur during the daylight hours of the winter months and the *lowest* values will occur during the night time hours of the winter months.

The relative position between the sun and the earth also affects the ionosphere on a *geographical* basis. Nearer to the equator, where the sun is always more directly overhead, the intensity of ionization is considerably greater than at higher latitudes where the sun appears lower in the sky. *Figure 7* shows the variation in critical frequency as a result of the geographical variation in the characteristics of the ionosphere.

Ionospheric Absorption

So far we have discussed only the characteristics of the ionosphere as a reflector of radio waves. Ionization not only can cause a radio wave to bend but can absorb energy from the wave as well. Ionospheric absorption is one of the factors that causes a reduction in signal strength as the wave passes through the ionosphere.

As a radio wave enters the ionosphere, it imparts energy to the ions that exist in this region. These ions are set into motion by this transfer of energy and thus convey the radio wave through the layer. While moving through the ionosphere, ions collide with much larger gas molecules that are also present in this region. As a result of such collisions the ions lose some of the energy originally imparted to them by the radio wave. In effect this lost energy is not propagated, and thus the amount of energy in the original wave is decreased resulting in a decrease in signal strength. The amount of absorption generally depends upon the number of collisions made per second, which is a function of the frequency of theradio wave. The higher the frequency, the less the absorption, with the actual value of absorption varying inversely as the square of the fre-quency. For example, the absorption on 10 meters is one-fourth the value of absorption on 20 meters and therefore when both bands are open at the same time, it will take considerably more power on 20 meters to equal the signal strength of the 10 meter transmission over the same path. This accounts for the strong signals possible on the 10 meter and to some extent the 15 meter bands, when using relatively low power.

Since the MUF is the highest frequency that can be used on a circuit, and since ionospheric absorption decreases with an increase in frequency, absorption is minimum near the MUF.

Ionospheric absorption depends upon the degree of ionization of the layers and varies greatly throughout the day and season of the year, with the actual value of absorption being proportional to the angle of the sun with respect to the earth. While absorption is present in all the layers, it is strongest in the lowest, or D-layer of the ionosphere, varying from an extremely low value at night to a maximum around noon. It is much greater near the equator, where the sun is more directly overhead, than in the temperate latitudes and is generally higher during the summer months than during the winter. As we might expect, the absorption of high frequency radio waves also varies throughout the solar cycle. During the years of minimum solar activity, when ionization is at its lowest value, ionospheric absorption is also at a minimum. During the years of maximum sunspot activity it approaches a peak, being approximately 3 to 10 DB *stronger* during the daylight hours of sunspot maximum than during the same period of minimum solar activity. The difference on the 10 and 15 meter bands is nearer the 3 DB figure, the difference on 20 and 40 meters nearer the 6 DB figure and on 80 and 160 meters nearer 10 DB. During the hours of darkness, when ionospheric absorption drops to very low values, the difference between sunspot maximum and minimum is on the order of 3 DB or so for all frequencies that are reflected by the ionosphere.

We can summarize therefore that the greater the strength of the ultraviolet radiation from the sun the greater is the degree of ionization of the layers, and the higher is the frequency reflected, and greater is the ionospheric absorption. If we ignore the variations in the ionosphere and attempt to transmit on frequencies chosen haphazardly, the chances of being able to maintain communications is very remote, for part of the time the wave will penetrate through the ionosphere and not return to earth at all, while at other times the signal may be completely absorbed. If, on the other hand, frequencies are carefully chosen to suit the conditions of ionization prevailing at any time, then the wave will be properly reflected, and will be able to travel great distances with very little loss of energy. The ability to maintain successful shortwave communications depends to a great extent upon the ability to *determine or forecast* the condition of the ionosphere.

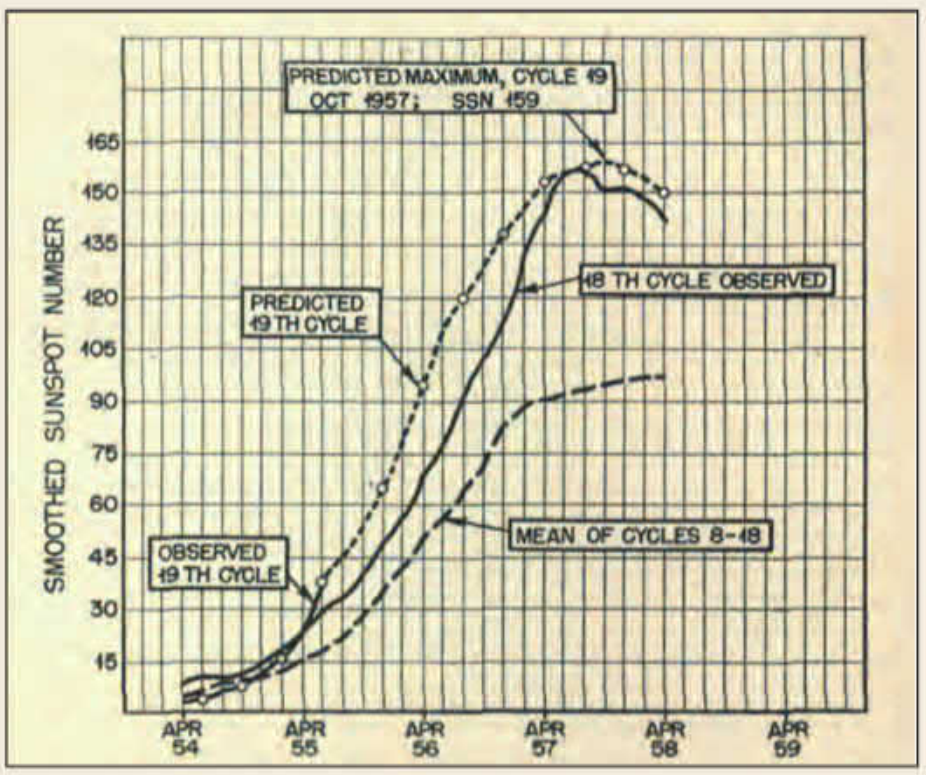


Fig. 9. A comparison of cycle 19, cycle 18 and the mean of cycles 8-18.

Forecasting

We have previously discussed at some length the relationship between critical frequency, maximum usable frequency, ionospheric absorption and the smoothed sunspot numbers. Since the correlation is very high between the smoothed sunspot number and ionospheric conditions, conclusions reached from study of the sunspot data may be assumed to apply to the ionospheric phenomena as well. If the latest trend in the sunspot cycle is carefully studied, it is possible to forecast a value of smoothed sunspot number several months in advance with fairly good accuracy. Being able to predict a smoothed sunspot number, it should then be possible to extrapolate the present trend of critical frequencies in a similar manner. If then the hourly and seasonal variations in the critical frequencies are taken into account it should be possible to predict the critical frequencies, and in turn the maximum usable frequencies for any circuit, for a given time of day or year throughout the sunspot cycle. In this particular discussion a forecast of this nature will be used for determining the effect of high sunspot activity, expected during the next few years, upon the various shortwave bands of interest to radio amateurs.

Since the discovery of the existence of a sunspot cycle by Schwabe in 1851, considerable interest in forecasting the trend of future cycles has been shown by a number of investigators. Until recently these predictions were largely of academic interest, but with the discovery of the close relationship which exists between radio propagation conditions and sunspot activity, the prediction of sunspot numbers has assumed practical importance. Obviously, since we do not know what causes sunspots or the laws of their exact behavior pattern, only some empirical method based on the general pattern of recurrences can be used in making estimates of the future of the sunspot cycle. Our forecast for the extrapolation of the present sunspot trend will be based upon an empirical approach similar to that suggested by Waldmeir of the Swiss Federal Observatory, Zurich. Waldmeir, by the way, correctly predicted the exact date of the last maximum.

Figure 5 shows the last complete sunspot cycle which began early in 1944 and came to an end during April, 1954, and was recorded as the 18th cycle since 1750. The maximum of cycle 18, reached during June, 1947, with a smoothed sunspot number of 157 was the highest recorded since 1778. Conditions for the transmission of shortwaves were therefore better during 1947 than they had been at any time since 1778, many years before the birth of radio itself. Cycle 18 touched bottom during April, 1954 with a value of 3.4, one of the lowest minimums ever recorded. The present 19th sunspot cycle began where the 18th left off, during April, 1954 with a smoothed sunspot number of 3.4. By June, 1955, just fourteen months later, it had soared to 37.8. The smoothed number for June is the latest available and takes

into account sunspot data for a complete year through December, 1955.

Figure 8 shows a sunspot curve of average sunspot numbers derived from the past eleven sunspot cycles, numbers 8 through 18. The average cycle is of 11.1 years' duration, but is not symmetrical on both sides of maximum. The average curve rises considerably faster than it declines, reaching its peak in 4.1 years. The maximum value of the average curve is a smoothed sunspot number of 98. In *figure 9* the present sunspot curve is compared to the average curve and to cycle 18. We see that the 19th cycle started below average but is now rising at an unprecedented rate, and has a much faster rate of ascent than either the average cycle or cycle 18, which was one of the highest cycles ever recorded. If this rapid rise continues, and at present all indications are that it will, the 19th cycle will rise to values *higher than have ever been recorded previously*. The extrapolation of cycle 19 shown in *figure 9* is based upon the present ascent compared to the slope of the rising portion of cycle 18 and the average cycle. According to this analysis, sunspot activity for March, 1956 should be on the order of 90 or so. Waldmeir has actually predicted a smoothed sunspot number of 88 for March, 1956. If cycle 19 follows the general shape of the average curve, the maximum should occur 4.1 years after the cycle began, or during May, 1958. The peak smoothed sunspot number would be on the order of 150 or so, *if the present trend continues*. On the other hand, cycle 18 reached its maximum only 3.3 years after it began, and there is a tendency for high cycles to reach their peaks somewhat earlier than the lower cycles do. Since there is little doubt that the present cycle will be a high one, there is a good chance that it will follow very closely the slope of cycle 18 and reach a maximum by September, 1957 with a smoothed sunspot number on the order of 160. Summing up this analysis we can say that the present trend of cycle 19 indicates that it may be one of the highest ever recorded and *if the present trend continues* it will probably reach a maximum value between September, 1957 and May, 1958 with the value of the smoothed sunspot number at the time of maximum somewhere between 150 and 160.

From ionospheric measurements made during cycle 18, it appears that once the smoothed sunspot numbers rise above 50, shortwave propagation conditions improve rapidly. The present cycle should have soared above 50 during October, 1955 and this accounts for the vast improvement in propagation conditions, especially on the ten and fifteen meter bands, noted this past winter. We can also expect a continuing improvement over the next several years. If the present forecast is correct, *shortwave radio' conditions during the next few years may be better than they have ever been in the history of radio.*

In Part Two of this article, appearing next month in CQ, the effect of the rapid rise in sunspot activity will be discussed in relation to shortwave propagation conditions on the amateur bands six through 160 meters. The effects, if any, in the VHF range and the possibility of DX television, as well as other shortwave transmission conditions will also be discussed.

75th Anniversary Special

CQ CLASSIC

This is perhaps the most classic of all CQ Classic articles — the column that launched the amateur satellite program. Semiconductors Editor Don Stoner, W6TNS, was experimenting with a low-power VHF solid-state transmitter that he discovered could be heard a hundred miles away, and started wondering about a hundred miles straight up! The "throwaway line" in his April 1959 column that appears below spurred the creation of Project OSCAR (Orbiting Satellite Carrying Amateur Radio) — as illustrated on our March 1961 cover — and with which Don became deeply involved, along with two other *CQ* columnists, George Jacobs, W3ASK, and Bill Orr, W6SAI. OSCAR-1 was launched in December 1961. Don's original column will be followed by his recollections, as well as George's, from our January 1995 50th anniversary issue. – *W2VU*

by DONALD L. STONER, W6TNS

semiconductors

Low frequency transistor circuits (below 30 *mc*) are rapidly becoming passe and reader interest seems to be swinging to vhf stuff. Following the trend, I am brewing up several circuits that will interest you high frequency hounds. Future columns will include a crystal controlled two meter transmitter with two transistors in the *rf* portion, a 420 transistor oscillator (transistor costs about $12.00!), and a two meter transistor receiver. **Currently being tested is a solar powered six meter to two meter transistor repeater which could be ballooned over the South West. Can any one come up with a spare rocket for orbiting purposes?**

This month's contribution comes from Jack C. Thomas, K6UQK. 4497 Rolfe Rd. San Diego, California. Jack designed and built the crystal controlled *vhf* converter shown in fig. 1, and uses it in conjunction with a Heath XR-1 transistor portable to listen to the glider frequency of 123.3 *mc*. LI tunes to the crystal frequency of a third overtone rock. The output tank is tuned to the third harmonic of the crystal, 121.56 *mc*. There is quite a bit of interaction between the oscillator output circuit and the mixer tank. CI and C2 are adjusted alternately to produce maximum output. The oscillator output is 50 microwatts and is sufficient for injection.

Sensitivity measurements indicate that a 3 microvolt signal is required for a readability. A glider, with a 1 watt transmitter, can be copied S9 at 5 miles.

The oscillator and mixer sections are mounted on a small chassis 4 5/8" X 1" X 1", which is bolted to the Heath chassis, above the speaker. No changes are made to the XR-1 and broadcast reception is unaffected. Coil L5 is wound over the base coil on the loopstick and the XR-1 is tuned to 1.74 *mc*.

Although Jack describes a specialized application, the experimenter could modify this circuit for other frequencies. I believe the Philco 2N588 will oscillate at a frequency that is suitable for two meter converter injection. Possible improvements might be the use of a 1N82A silicon diode and the addition of an *if* amplifier. This circuit should work on six meters using the Philco T-1324 which nets for $1.65.

Speaking of the T-1324, I have been doing some experimenting out near alpha for this device. Alpha is rather difficult to check without elaborate test equipment, so I used the transistors in a overtone circuit. The highest frequency crystal available was an International 5th overtone on 72.02 inc. The circuit shown in fig. 2 was constructed and optimized for 72 *mc*. Of six transistors selected at random, five oscillated at the crystal frequency and produced between three and five mw output with 10 mw in. The sixth transistor was even sluggish on six meters.

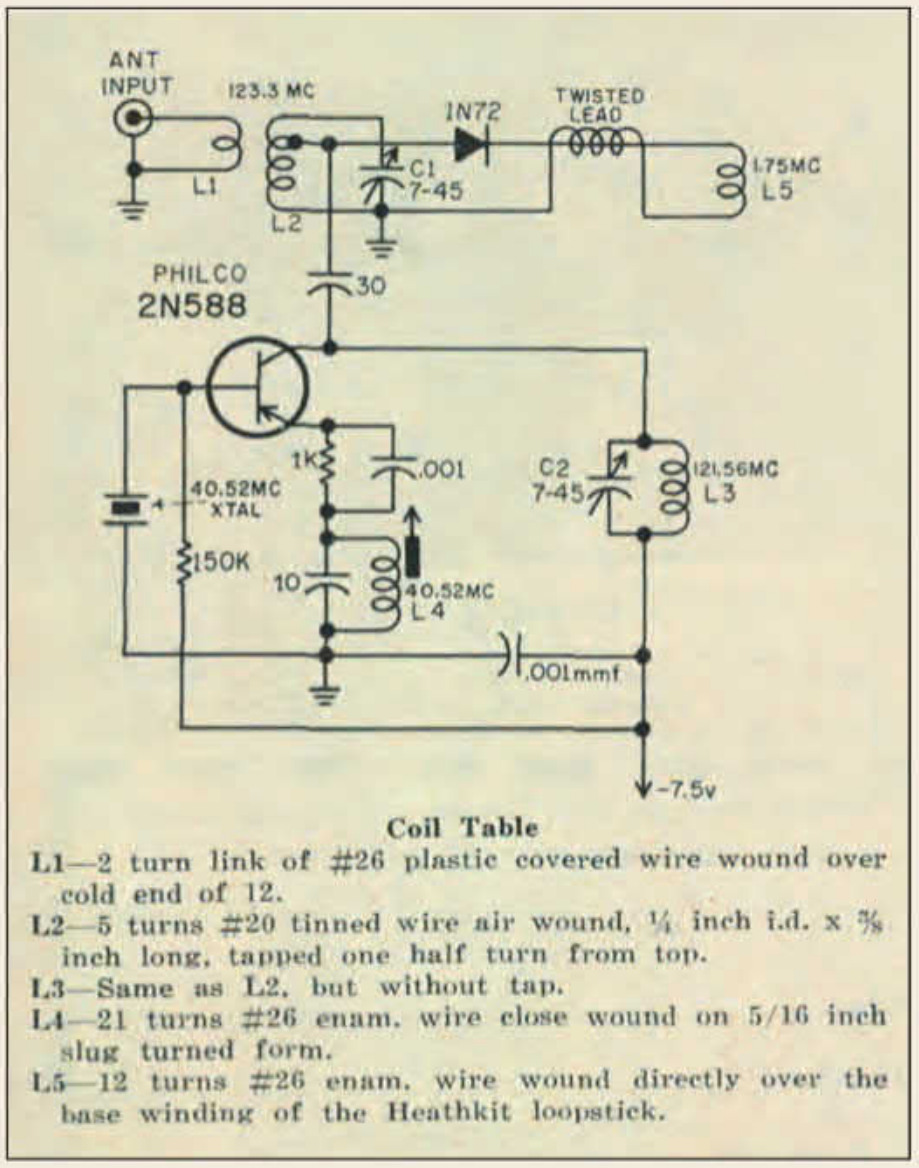
Although the T-1324 is rated to dissipate only 10 *mw*. I have used it in the oscillator circuit shown running at 24 mw input (8 volts at 3 *ma*) for several weeks constantly. Power output is steady at 10 *mw*. Transistor ratings were made for engineers, not hams—hi.

This circuit could be used to drive a Philco 2N500 ($10.90) or Philco 2N502 ($12.40) as a doubler to two meters.

New Literature

Kupfrian Mfg. Corp.. 395 State St., Binghamton. N. Y. is providing data sheets on their line of transistor power converters. Good prices, particularly the kits. Drop them a post card if you're in the market.

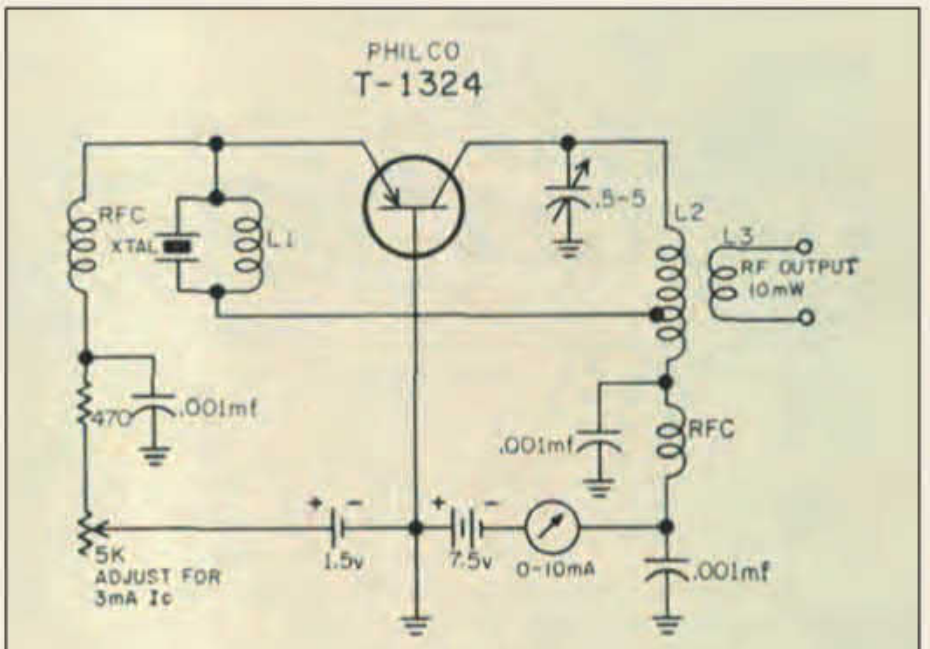
Sylvania has come out with a transistor course, that looks very good. Don't know at this writing if it is available on a tube deal or to experimenters.



Coil Table

L1—2 turn link of #26 plastic covered wire wound over cold end of 12.
L2—5 turns #20 tinned wire air wound, ¼ inch i.d. x ⅜ inch long, tapped one half turn from top.
L3—Same as L2, but without tap.
L4—21 turns #26 enam. wire close wound on 5/16 inch slug turned form.
L5—12 turns #26 enam. wire wound directly over the base winding of the Heathkit loopstick.

Fig. I. VHF converter circuit designed and constructed by Jack Thomas, K6UQK



Coil Table

L1—Approximately 25 turns #26 enam. wound on ½ watt 1 meg. resistor. This coil should resonate with the crystal and crystal socket capacity to about 3 mc. higher than the overtone crystal frequency (72 mc.). In this circuit it resonates at 75 mc.
L2—5 turns, #16 tinned wire, ⅜" i.d. spaced diameter of wire, tapped one turn up from cold end.
L3—2 turns, #22 plastic covered hookup wire. Adjust coupling for max. power output.
RFC—Approximately 50 turns #26 enam. closewound on a 1 watt 1 meg. resistor. This should resonate with the full resistor lead length to overtone frequency (72 mc.).
Xtal—5th overtone xtal, International FA-9 for 72.02 mc.

Fig. 2. 72 mc crystal controlled oscillator circuit

Texas Instruments, Dallas, Texas, has a new publication—New Parameter News (NPN); this describes applications for their transistors. Issue #4 shows how to use their tetrode transistors up to 150 inc.

Need a good catalog on rectifiers? International is mailing their short form catalog covering 405 types of silicon and selenium rectifiers. For a free copy, write International Rectifier Corp., El Segundo, Calif, and request "short form Catalog."

More literature on transistor power converters is available from Creative Electronics, 94 Lincoln Avenue, Stamford, Conn.

Semiconductor News

General Electric is going great guns with their silicon rectilier line. Thirty seven stud types and twenty lead mounted cells have been added. Bulletins ECG-349 through ECG-351 describe the new units.

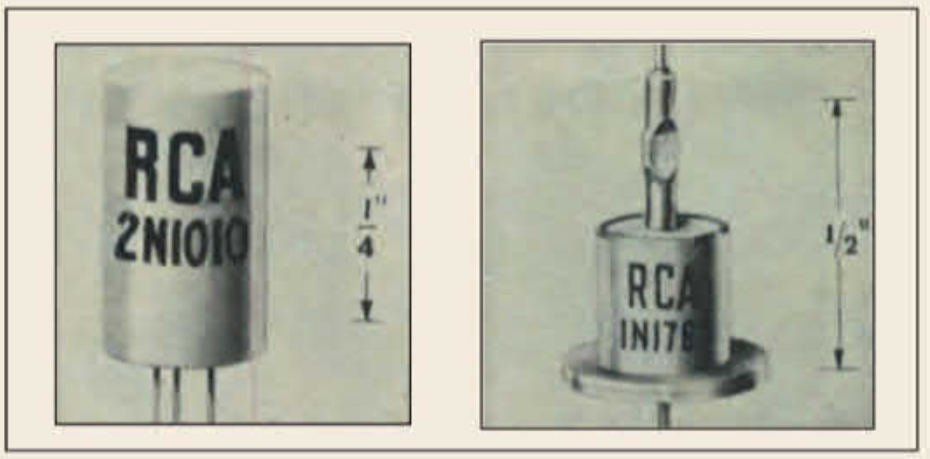
Of interest to industrial readers is the General Electric Silicon Controlled Rectifier. This is a three terminal device that acts like a regular diode, until a signal is introduced to the gate terminal. Upon applying voltage to the gate it conducts like a piece of #00 bus-bar wire. Data sheets on the C35 and ZJ39L are available.

International Rectifier Corp. is now marketing calibrated solar cells for calibration and accurate radiation measurements. Each cell is selected to have at least 9% conversion efficiency. Bulletin SR-277 describes them.

Miniature silicon rectifiers in a bridge configuration are also available from International Rectifier Corp., El Segundo. California. These assemblies occupy only 1/10 the volume (see photo) and weigh less than 1/60 of equivalent tube circuitry. Bulletin SR-207 describes them.

Olson Radio Warehouse, 260 South Forge St., Akron, Ohio, is marketing a new line of "Shield-Crest" transistor and portable radio batteries. If Olson runs "true-to-form" these should be much less expensive than other types.

As hinted earlier. Pacific Semiconductors, Inc., 10451 West Jefferson Blvd., Culver City, Calif., has entered the transistor field, and in a big way too! Six transistors, de-



The RCA 2N1010 is a super lo-noise audio transistor. Don't overlook this one, when de-signing that speech amplifier circuit. Data sheets are available. Although intended for radio and TV applications, these new RCA IN 1763 and 64 rectifiers will be bargains for experimenters.

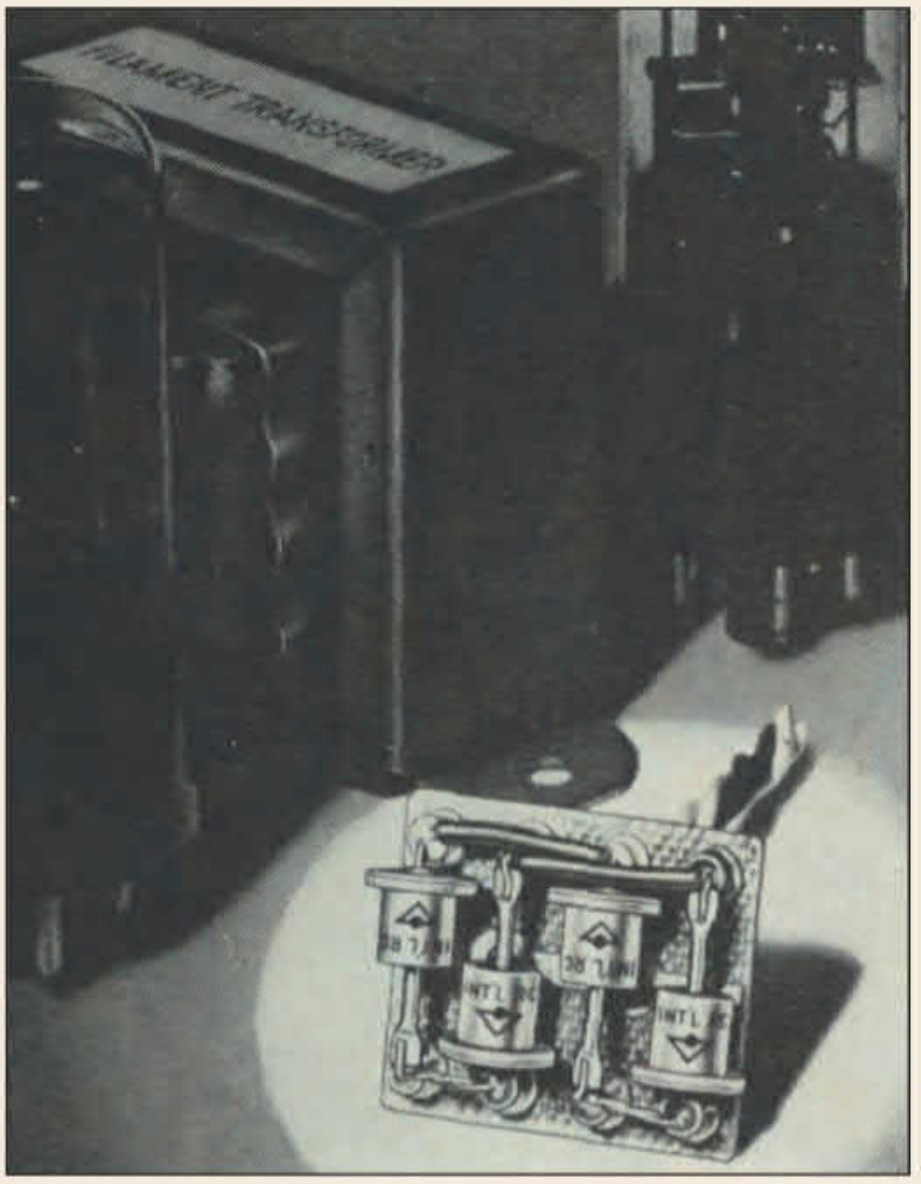
signed for satellite use, spear-head the line. Here they are: Oscillators, XT-515, XT-516, XT-517, Amplifiers, XT-518. XT-519, XT-520. All six have the following rating: V_{CB}-16 Vac peak, V_{CB}-120 Vdc, Ic-75 ma., Junction temp. T_j-150° C, Dissipation 2.8 watts at 25° C. The oscillators will produce 250 *mw*, 500 *mw*, and 750 *mw*, at 75 *mc* with 80 volts on the collector, drawing 30 ma. The amplifiers will provide 10 db of gain with the same power output ratings! Alpha cut-off is in the vicinity of 1000 *mc* (no fooling!). Although these units are available for experimental work, the price is in the $100 range. A production speed-up should yank the price down sharply, in the near future. See you on two meters.

You can now purchase the 1N1763 and 1N1764 silicon rectifiers (described in an earlier column) at your RCA distributor. These units have a 400 and 500 piv rating respectively. Write RCA at Somerville, N. J. for data sheets.

The RCA 2N1010 is a natural for Amateur speech amplifier applications. This transistor is designed for lo-level audio (phono cartridges, tape recorders, etc.) 1st amplification stage. The noise factor is only 5 *db* with 15 *kc* bandwidth! Data sheet available.

RCA has opened a new semiconductor facility in Findlay, Ohio, and the first transistor rolled off the production line on Feb. 5, 1959. The Findlay plant will turn out several different transistors designed for radio and phono applications. Later on, auto radio transistors will be made there also.

Sylvania Electric is now packaging diodes in an all glass enclosure with max. dimensions of .265"L and .l05"D. That's it for this month, be sure to watch next month for that xtal controlled two meter transmitter circuit. 73, Don, W6TNS



Introducing Internationals' new packaged bridge rectifiers. Other circuit configurations including half-wave, center-tap doubter, and full-wave rectifiers are available on request.

DI-DI-DI-DIT, DI-DIT

By DONALD L. STONER, W6TNS

CQ has always taken great pride in its leadership in promoting innovations such as single sideband, mobile communications,RTTY and amateur space communications. Nowhere is this tradition of leadership more evident than in the story of how CQ got Project OSCAR off the ground.

Each of us at one time or another has said something, made a recommendation or taken an action that has had a profound effect on others. Some, like myself, know the inner thrill of affecting history with nothing more than a simple statement.

In the late 1950s I was the Semiconductor Editor of CQ magazine. The gigahertz-busting devices we employ in our SHF preamps today were just a gleam in the eyes of physicists back in the "good ole daze." In fact, when I started writing the CQ column, silicon and gallium had not been used in those tiny, metal miracles. Germanium was the element de jour, and getting a transistor to work at 144 MHz required an equal mix of skill and black magic incantations (as in "oscillate, dammit!").

As the decade came to an end, I had pushed up my various transmitter designs from 5 or 10 milliwatts to a rock-crushing 50 milliwatts (yes, all of 0.05 watts). On a nice summer weekend my bride and I piled into the family jalopy and headed for WA6EJI's home away from home in the San Bernardino mountains at Running Springs, California. Tony had offered to let me put the tone-modulated beacon and a 38 inch dipole antenna up on the roof of his cabin as an experiment.

Lo and behold, my germanium gargantuan was heard in San Diego, 120 miles south, and with an S9 signal strength! Now you don't have to be a propagation guru to realize that signals from 120 miles straight up should be as good as, or better than, signals from 120 miles over land!

And so it came pass that I published the circuit for the tiny transmitter in CQ magazine along with the cutesy comment "Does anyone have a spare rocket for orbiting purposes?" And someone did! No sooner had the magazine hit the mailboxes than I received a call from Fred Hicks, W6EJU, up in Sunnyvale, south of San Francisco. Fred was involved with the Lockheed Amateur Radio Club. He excitedly told me that Lockheed, which had an excellent working relationship with the Air Force, just might be able to inject a beacon into orbit.

Talk about skeptical city. Lockheed made and orbited top-secret goodies for the government. Share a ride with something that didn't officially exist? No way, I thought. But thanks to the influence and perseverance of those too numerous to mention, it did happen. And, as they say, the rest is history.

The moral of the story, guys, is Watch what you say. Someone just might take you seriously.

CQ in the Space Age

By GEORGE JACOBS, W3ASK

In addition to editing CQ's propagation column for the past 44 years, George Jacobs, W3ASK, was a pioneer in the development of the amateur radio OSCAR satellites and the formation ofAMSAT. For many years, George was also editor of CQ's "Space Communications" column.

All of us in amateur radio were very excited over the Soviet launching of the first Sputnik satellite in October 1957. Shortly after the Sputnik launch, Don Stoner, W6TNS, in a classic article in CQ, challenged radio amateurs to develop and have launched for them a piggy-back radio amateur satellite. An outstanding group of licensed radio amateurs living in California, including some of America's leading satellite engineers and scientists at the time, formed the OSCAR committee in 1959 to meet this challenge. The name was derived from Orbiting Satellite Carrying Amateur Radio. I joined the OSCAR team as publicist and government contact. This gave birth to CQ's "Space Communications" column, which made its debut in December 1960 and appeared monthly for six years. This was another first for CQ, for no other publication took OSCAR seriously then.

One of my biggest thrills in amateur radio was the successful launch of OSCAR-1 on December 13,1961.1 still "tingle" today as I recall hearing the satellite's beacon peep out *HI* from space in the 2 meter band.

A second OSCAR beacon satellite was successfully launched in 1962. On March 9, 1965, OSCAR-3, the first amateur radio two-way communication satellite, was launched successfully. Amateur radio had now truly entered the age of space communications. OSCAR-3 made historyright from the start with world-wide contacts being made through it, erasing any doubts that amateur radio had an important role to play in space communications.

In 1969 I reviewed the success of the OSCAR program with a group of east coast space scientists and engineers near Washington, D.C. It was evident to me at the time that with the design and building of larger and larger satellites, and with world-wide participation, the OSCAR concept had to be enlarged. As a result of my comments at this meeting the AMSAT-OSCAR organization was formed, with the official name Radio Amateur Satellite Corporation. The first satellite launched for AMSAT was dubbed AO-5. It was designed and built by students at the University of Melbourne in Australia. It contained beacon transmitters on 2 and 10 meters. The rest is history. AMSAT-OSCAR to date has had ten communications satellites launched that were designed and built by its members. Affiliated AMSAT organizations in Russia, Japan, Germany, France, United Kingdom, South Korea and Italy have also designed, built and had launched several additional radio amateur satellites. The amateur radio satellite program has not only provided new ways for long-distance communication, it also clearly demonstrates the purpose of amateur radio: voluntary contributions of communication knowledge and time motivated only by personal satisfaction.

I am especially proud to have been a part of the radio amateur satellite program from its inception. It has touched my life in a very positive way, as I am sure that it has also touched the lives of the thousands of radio amateurs and others who have voluntarily participated in amateur radio space communications during the past 34 years. What better way to learn about space communications than by participating in it?

George Jacobs, W3ASK, and Bill On, W6SAI, holding the OSCAR-1 satellite shortly before its December, 1961 launch. Both George and Bill still write regularly for CQ.

75th Anniversary Special

This issue contains a lot of ham radio history. But actually, each of us has his or her own personal history in the hobby. Ham radio has provided many things to many people, and launched many a career. Here, AK6OK shares his own ham radio story, starting at age 5!

A Personal Ham History

A Look Back on My First 60 Years of Amateur Radio

BY JEFF HILLIARD,* AK6OK

At about 5 years old, I started to realize how cool amateur radio was. My dad, Jim Hilliard, W6CGS, was my mentor. Every weekend morning, he and I talked from our home in Concord, California, near San Francisco, to my Uncle Dick, W6TCU, 375 miles away in Santa Monica, using 40-meter AM. Dad's Multi-Elmac AF67 transmitter (*Photo A*) just hummed along, with its external homebrew power supply and fixed-frequency crystal. Back in those days, the late 1950s, the transmitters generally used plug-in crystals instead of a VFO to set the frequency. And both stations weren't always on the same frequency, either, because the crystal frequencies at each end were not necessarily the same. Some guys had only one or two crystals for each band. If you wanted to change a crystal's frequency, you could disassemble the FT243 holder, remove the quartz element and, using Ajax or toothpaste, grind the crystal a bit on a piece of glass and move it in frequency. But the change was permanent.

My dad's Hallicrafters Model S-40B communications receiver was just as cool. I used to love to just sit down and turn the knobs on the receiver and listen, even though I didn't even know what I was listening to. I was so enthralled with it all that I started to soak it all in and, at about 10-11 years old, in the early 1960s, I learned the code and got my Novice license, WN6IOK. Every novice had a "N" in the prefix of his or her callsign.

My dad had a homemade tower back then, made of wooden 2 x 4s and some steel (*Photo B*). It was about 50 feet tall. He used to climb it to install and maintain his antennas. But in 1956, the tower blew down in a windstorm, narrowly missing our house. Fortunately, it never came down while he was at the top.

FCC Exam in San Francisco Office

I will never forget the FCC exam room in San Francisco. At that young age, sitting in front of the FCC examiner just terrified me. To me as a kid, just the letters F-C-C represented everything you should be afraid of in life. I knew that if I transmitted without a license or transmitted just out of the band, the FCC enforcers would be right there to arrest me and take me to jail. Forever!

The FCC examiner in San Francisco was a cranky older man and he smoked a big cigar. And when he spoke to all of us, it just sounded like a barking dog. We were on the second floor of the FCC office at 555 Battery Street with the room

Photo A. My dad's transmitter back in the 1950s was a Multi-Elmac AF-67, just like the one shown here from SM2CEW's website <http://sm2cew.com/multielmac.html>. It was joined by a Hallicrafters S-40B receiver.

always full of cigar smoke. And the tilting windows were always open to the street. Noise like car horns, jackhammers, and sirens were a continual distraction. And you didn't dare look at anyone else in the room during the test. Any ham from back in my day has had this experience, and I think that examiner was there his entire life. Somehow, I made it through that experience unscathed. Thankfully, those days are long gone. To pass the code test, you had to send and receive at least 1 minute of solid code without errors, with all of the noise and distractions. It was grueling to say the least.

The Novice license had a fixed term of two years and then it expired. No renewals. If you didn't upgrade before the expiration date, you were done. That prompted me to study for my General license, which I passed in time, but still had to go to the FCC office and do it all again, with the same old examiner. My new General Class call was WA6IOK. (When you upgraded, the FCC removed the N in the prefix of your call and replaced it with an A. So my previous call of WN6IOK became WA6IOK.)

The Mt. Diablo Amateur Radio Club

I always went with my dad to the Mt. Diablo Amateur Radio Club meetings at the old Red Cross building in Walnut Creek,

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Photo B. My dad, Jim Hilliard, W6CGS, on his home-built 50-foot wooden tower. (Note the heavy-duty climbing belt!). The tower came down in a wind-storm. (Photos B-E courtesy of the Hilliard Family Archives)

Photo C. Dad was very active with the Mt. Diablo Amateur Radio Club, and the group enjoyed mobile operating. From left to right are my Uncle Dick, W6TCU; I don't know the gentleman next to him; my dad is the guy in white outfit by his car. Next is W6ASH, one of the founders of a local club in San Jose, and on the far right is Bob Richter, W6HOF.

California. My dad went way back in the club and, as you can see from *Photo C*, he was pretty active as well. As you can also see, it was cool to have your call-sign on your black and yellow California license plate. And HF antennas on their cars were pretty common, too.

But you should have seen what kind of radios they ran in their cars. Most of the mobile radios back then were tube models because solid-state electronics just wasn't available to the average ham then. Surplus gear was becoming available in the late 1950s, such as the GE Pre-Progress line of mobile radios, using a vibrator or dynamotor driven power supply. These were UHF or VHF FM mobile radios running less than 20 watts.

For you who have never heard the term, a dynamotor (motor generator) is one way low-voltage DC was converted into high-voltage DC to run tube radios. This type of device was commonly used as a power source for mobile commercial and military radios from the days of the first mobile radios up until the late 1950s when transistors began to be used in inverter circuits to create the high voltages needed for tubes.[1] When you would key your transmitter, there was a delay of at least 1-2 seconds as the dynamotor required time to start up to supply the high-voltage DC to the finals. And on the air, you could always hear the dynamotor winding up.

But the radio of choice for many of the guys in the Mount Diablo Radio Club was called the Link 6000, a commercial VHF radio that included a complement of tubes in the receiver and transmitter. Dad and I installed one in our first Volkswagen Karmann Ghia.

The transceiver used vibrator technology to achieve high voltage.[2] Before the development of switch-mode power supplies and the introduction of semiconductor devices operating using low voltage, there was a requirement to generate voltages of about 50 to 250-volts DC from vehicle batteries. Electromechanical components known as vibrators were used in a circuit similar to modern solid-state inverter circuits to provide a pulsating DC which could be converted to a higher voltage with a transformer, rectified, and filtered to create higher-voltage DC.

When you parked your car, you didn't want to forget to turn off the radio. If you left it running, the Link 6000 could easily deplete your car battery in one hour or less.

T-Power

As technology continued to improve, newer solid-state mobile and base UHF and VHF FM radios started to appear on the surplus market. If you had a Motorola radio with "T-Power" or Transistor Power, the new solid-state model, you were really considered "hot stuff." And you could tell which hams were using the new radios because they had a tell-tale, high-pitched tone as they spoke. We were always in awe of the hams who had a solid-state mobile radio. We knew that if you had T-Power, you were either "rich" or you knew someone at Motorola.

The club participated in many events each year. My most memorable was the trek on horseback over and around Mt. Diablo, a 3,848-foot mountain right there in the Diablo Valley. Club members provided communications for this annual Labor Day event to provide direction and safety to the hundreds of horseback riders. The best part was all of us hams riding in old 4-wheel drive Jeeps outfitted with Gonset Communicator Civil Defense 6-meter AM radios (*Photo D*). Many hams had these yellow Gonset radios on semi-permanent loan from the local Civil Defense organizations. We always had free run of the mountain and I always felt pretty special using my callsign and assisting with communications while still being a kid. We also provided communications for parades and other events in the area.

The W6CX VHF Repeater

Members of the club, including my dad, built the original W6CX VHF FM repeater, made from a LINK 6000 tube transceiver, and installed it on top of Smith Hill, just outside of Walnut Creek, California. This little known 500-foot knoll was a perfect spot for easy access and great VHF coverage. We installed the repeater antenna on a windmill tower.

Controlling the Repeater

The repeater had an autopatch, one of the first of its kind in the San Francisco

Bay area. And phones then were rotary phones, not push-button phones like we have today. To access the phone system, we installed rotary dials in all of our cars. If you were one of the privileged few control operators of the day, you could dial a few digits from your car and automatically take the phone line off the hook at the repeater site. Then the pulses provided by the dial would directly access the phone network and connect the call. Technically, accessing the dial in the car simply sent a 600-Hz audible tone over the air and when you dialed a digit, the relay up on the hill would pulse the same number of times based on the digit you dialed. The club technical team fashioned up some simple logic that would take the phone off hook when a series of the correct access digits were dialed. You would hang up with a similar set of digits.

Touch Tone® Signaling

A few years later around 1963, AT&T introduced Touch-Tone®, also known as dual-tone multi-frequency signaling, or DTMF.[3] The ham community was just buzzing about the new technology. But the original tone decoders, full of audio filter boards and relays, were the size of a repeater or larger. Eventually though, Touch-Tone decoders were built into a single DIP IC. Advanced Computer Controls in California created the RC-850 controller using this new decoder technology and built the most amazing repeater controller that I knew about. Hams would have to scrape together over $2,000 (in 1980s dollars) to get the latest technology controller but it had so many functions like multiple steerable remote bases, autopatches using Touch Tones, linking, voice ID messaging, reverse autopatch, automated temperature and voltage readings, and much more. This is what caused repeaters to be so popular. Repeater controllers today are much smaller, have more capabilities, are much less expensive than ever, easy to get, and very easy to install.

Burst Tones Instead of PL®

PL® – Motorola's trade name for CTCSS, or Continuous Tone Coded Squelch System — had not been used in amateur gear in those days but to reduce interfering stations, we would use what was called burst tones. A burst tone is a short tone, normally less than a half-second, that would start when you key up and then drop. This tone would be decoded by a filter at the repeater, indicating you were one of the club users. Not too secure, but it took care of some of the basic issues we had. If you have any old VHF or UHF radios from that time period, you probably have seen the option for a "burst" signal.

HF Radio Back in the Day

My greatest and most treasured memories of those days was the propagation on the HF bands. From 10 meters through 160 meters, the bands were on fire with S9++ signals every day on every band. And depending on the time of day, you always had someone to talk to. When I was about 14 years old, I would rush home after school and get on the HF radio. I used a Heathkit SB-101 transceiver running barefoot to a 14AVQ vertical mounted at the peak of our 2-story roof. The signals on 10 meters were absolutely stunning every day. Pile-ups were a daily occurrence. All I had to do was pick a 10-meter frequency, make a quick CQ call and sit back and wait. The biggest HF pile-ups were always from Japan, with sometimes 20-30 stations trying to work me at a time. With the current sunspot cycle conditions, I'm not sure if I will ever get to experience that rush again. It was a great time in my life. QSOs to Australia and New Zealand were a nightly occurrence, too. Just amazing propagation! And 75 meters at night was also full of fun times. I remember a few of us younger guys harassing a net control here and there, but as I grew older, my good sense took over. The 75-meter band was a great meeting place.

A High-Power Experience

A good friend of mine — another young ham — and I used to hang out together on the bands and in person. His father worked as an engineer for Voice of America. One quiet evening, he invited me for a personal tour of the station with his dad, which I jumped at. We drove to the site and his dad walked us through the power supply room, a 500-square-foot room full of huge capacitors, transformers, and solid copper straps to tie it all together, and DANGER signs everywhere. And then the room where the finals were kept. Some of these final tubes were large enough to climb inside. It all seemed to be just a massive copy of my Heathkit SB-200 amplifier.

Photo D. One of the club activities I remember best was the annual Mt. Diablo horseback trek. Hams would take old Jeeps up along the trails to provide direction and safety for hundreds of horseback riders. We used 6-meter AM Civil Defense Gonset Communicators.

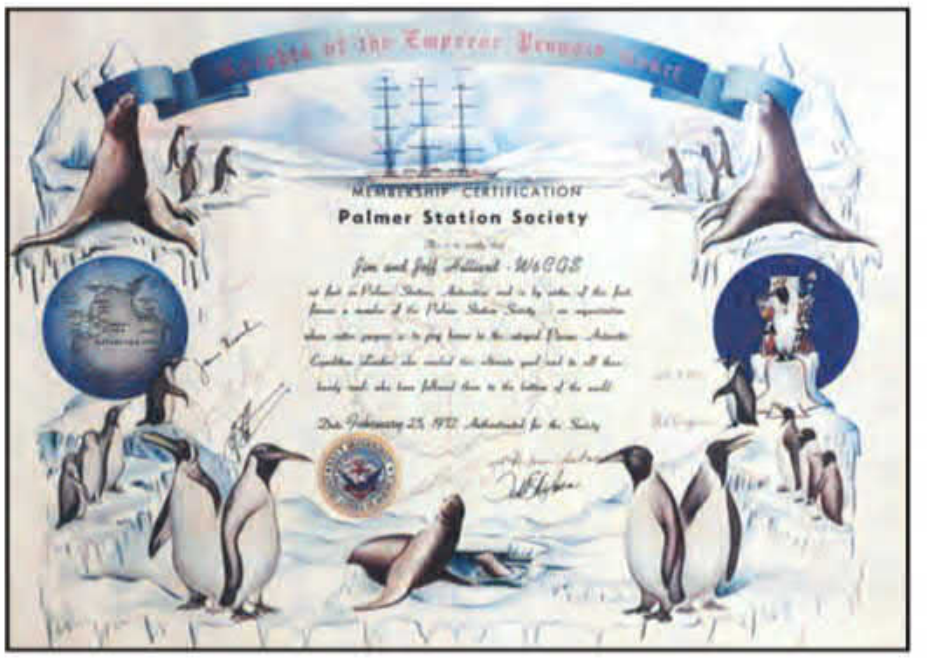

Photo E. In the early 1970s, Dad and I were presented with this certificate in appreciation of our frequent phone patches from UC Davis researchers at Palmer Station in Antarctica to family members back in California. We also used the station to let a UC veterinarian guide emergency surgery on a Palmer Station dog.

The Voice of America transmitter was off the air that evening and 20 meters was completely dead. Not a single station could be heard, even though we were listening on a huge rhombic antenna and using an awesome Collins KWM-2A transceiver, the station they had there. His dad said, "Let's call CQ on 20 meters and see what we can stir up." After a series of complicated power-up procedures, he tuned the transmitter up to 500,000 watts (yes, 500 kilowatts!) in the 20-meter band and made a single CQ call. A KL7 station in Alaska replied and we could barely hear him. He couldn't understand why we were so loud. "You are pinning my needle up here in Alaska and the bands are completely dead! What a signal!" We wrapped up that conversation quickly and shut it all down without much of an explanation.

Now, of course, all of us know that what we had done was quite illegal. But here I am almost 50 years later and I remember it vividly. What an impression it made on me and what a moment in time. I worried about that experience for many months, thinking the FCC would one day walk through my door, but it never happened.

Palmer Station, Antarctica

Since the band conditions were so good in the '70s, and living in Davis, California during my high school years, my dad and I started providing daily phone patches between UC Davis scientists and researchers at Palmer Station, Antarctica, and their families back home. We had a Mosley TA-36 beam at about 60 feet and it was just a pipeline between Davis and the South Pole every evening on 20 meters. Dad and I traded off from day to day, but it was pretty much an every-evening event for a few years. The certificate you see in *Photo E* was presented to us in 1972 in appreciation for all of the time we spent using ham radio to further science.

During one of these sessions, we heard that the onsite dog was suffering from some type of sickness. We set up a special time as the UC Davis veterinarians guided the researchers through performing critical surgery on their dog using amateur radio as their only means of communication. This 3-hour surgery was another moment in history for me, one that proved the importance of ham radio as being a needed public service.

Long-Term Impact

So where did all of this lead a young man like me? I attended general education classes in college for two years with a major in biomedical engineering, but ended up starting a career before I ever took an engineering class. From what I learned in ham radio alone, and through some basic self-study, I became an inventor of many products like the talking elevator for Otis Elevator, and the first automated restaurant seating system now used all over the world. Strangely enough, I was also the inventor of a genetic fusion system called the Progenetor and the co-inventor and electrode designer of the process used to make many types of plants, including seedless watermelons. We developed tomatoes that contained 10% less water used to make tomato paste, saving the canning companies $30 million a year at that time by using less fuel. But these are stories for another day.

Ham radio has been my life from a very young age. It has been a blast every step of the way and I continue to learn more and more today. From software-defined radios to the new digital modes, I continue to learn a lifetime of information every year. And I owe it all to my dad Jim, my Elmer,[4] who got me started early, explaining it all on a daily basis. I caught the ham radio bug and now I am the Elmer. And if your situation is similar to mine, you should be handing this important public service down to younger people as well.

Ham radio continues to thrive and the technology is just getting better. As some of the older hams are passing away, so is the history they had in their heads that was never passed forward. This rich history can't just die. Tell your story. Share the fun we have had over all of these years and get these younger people fired up like we were. When the HF bands come back, they can share in the fun knowing the history of what made ham radio what it is today.

The sunspot cycle will turn around and that awesome fun will start again. And as I see young people say all of the time on social media sites: "Wait for it!"

Notes
1. Dynamotors - <https://tinyurl.com/s4tnmok>
2. Electronic Vibrators - <https://tinyurl.com/nrpfw8f>
3. Touch Tone® Signaling - <https://tinyurl.com/ncnoz5h>
4. Discussion of Elmer - <https://tinyurl.com/y9799o6b>

75th Anniversary Special

As we look back 75 years to the founding of CQ magazine, WØCP takes us back even further, to the very first radio amateur, Guglielmo Marconi, through a bit of historical fiction in the voice of one of Marconi's childhood friends…

My Friend "Elmo" – Personal Recollections of Guglielmo Marconi

BY WALT STINSON,* W0CP

I recently read the fascinating new biography of Guglielmo Marconi by Marc Raboy, Marconi: The Man Who Networked the World*. I was struck once again by how profoundly radio has changed our civilization, connecting us in ways never before imaginable — ways that we take for granted today. I was also struck by the parallels between Marconi and many of the technology giants of our day: Gates, Jobs, and Musk, just to name a few. That Marconi's worldwide fame and stature surpassed them all is a fact obscured by time. This is known: Radio transmissions worldwide went silent for two minutes at 1700 GMT on July 22, 1937, during Marconi's funeral ceremony. What went into being the first to discover the potential of radio, to envision what it could become, and to launch a revolutionary new industry before the age of 21? We learn some of the answers in this fictionalized account of Guglielmo's ("Elmo's") youth as told through the eyes of his childhood best friend. – WØCP*

Everybody wants to know about Guglielmo, now that he's dead and all. They want to know about our childhood together. That's why I'm talking to you. I am going to tell you, and you can spread it around, and that's it. I am done with it after I talk to you.

Now, don't get the wrong idea. It's not that I don't like talking about Elmo, because I do. It's just that with him being the most famous person in the whole world, it's been too much pressure. Too many reporters hanging around asking questions; my wife is getting on my case and I don't blame her. I mean it's not like they're paying me or anything, and even worse, they don't know anything about it. That's why I'm talking to you. But yeah, I know the whole story of what happened, and since you're into wireless and Morse code and all, I figure I can trust you to get it straight.

People say Guglielmo wasn't smart because he never attended a proper school, but they've got it all wrong. Elmo was the brightest kid in the village. His older brother, Alfonso, got his early schooling in England at Bedford. Elmo and his mom lived there off and on until he was six. He figured he'd get the same treatment as Alfonso and was looking forward to it. But, no. He was stuck at the Villa Griffone and not even his mother could talk Don Marconi into letting him go back to England for school. You see, Elmo was bored out of his mind. Can you imagine being a teenager trapped at that villa? I mean, it's a really nice estate and all, but in his mind, it was a prison. His father didn't even let him go to school in Pontecchio with the rest of us. Brought in tutors. Some kids would have rebelled, but Elmo didn't. He respected his father too much for that. For the most part, he just accepted and made the most of it by trying to please his tutors.

Elmo and I were the same age. We made friends at church when we were 13 and played together all the time. He was a good horseman and taught me to ride, too. We rode around the Villa Griffone and just hung out talking about girls and science. We were both into science stuff, and girls just as much. He didn't actually have a girlfriend, though, so the only thing that got him by was that he really admired his science tutor, Vincenzo Rosa, and wanted to impress him.

Rosa told Elmo about everything that was going on with electricity in Italy, Germany, and England and kept him up on all the latest inventions, like the telephone and how it was spreading around Italy, and got him all excited about it. You see, Elmo figured we should keep in closer touch about stuff and we didn't have any way to do it. He had to come into town

Guglielmo Marconi, age 21, with his invention — wireless telegraphy — 1895

* <wstinson@listenup.com>

and visit me or I had to hoof it out to the villa, and it was really a pain. We wanted the telephone but it wasn't in Bologna, yet. So, we decided to build our own telephone line from magazine articles and drawings that Rosa showed Elmo about what Bell was doing in America. Anyhow, that never went anywhere because we found out how much it would cost, we didn't have any money and Elmo couldn't talk his dad into giving him the money for it. So, that plan was dropped.

A few years later, Rosa took Elmo to meet a friend of his, Augusto Righi, at the University of Bologna. Righi and Elmo really hit it off. Righi told Elmo all about what Heinrich Hertz was up to. When we finally met up again, he had a new plan. We didn't need any wires, he said. We would just use Hertzian waves to signal each other with Morse code. Righi sent Elmo some articles about Hertz's experiments and we went to work on copying them. Elmo's dad was down with it because it was going to be a lot cheaper than our first idea and because Rosa convinced him that it would be good for Elmo to experiment with this new breakthrough in physics.

So, that's how the whole wireless thing started. It didn't matter to Elmo that scientists were convinced the waves would not travel very far. In his imagination, they could, and Rosa didn't say anything to dissuade him from trying.

When Elmo turned 16, he got a butler. His butler was named Roberto Mignani. At first, Elmo didn't know what to do with Mignani and vice versa, but when we started the wireless project, it finally dawned on Elmo that Mignani should be our assistant. I was kinda Elmo's assistant too, so I guess he had two assistants, me and Mignani. But, truth be told, I was actually Mignani's assistant because he was really good. You really couldn't expect much ingenuity from a butler, but Mignani was no ordinary butler. He could make just about anything and, if he couldn't, he knew someone who could. So, when Elmo enlisted Mignani, that's when things really got going. Hertz had detected a wave across the room and Elmo wanted to go farther, so that's what we did. We had all the details, copied the experiment, and tried it out. It worked just like Righi said it would.

The First DXers

Elmo was very excited to see just how far the waves could go. You see, he had this idea about using Hertzian waves for signaling and connecting people over long distances. Nobody else in Italy, Germany, or England cared a whit about communicating with wireless but it's all Elmo focused on. We called it "the distance game." We started at about 10 feet and went from there. Alfonso and Mignani were all in with our game. They thought it was fun, too. So, every week for a year we'd set up a new test to make a new distance record. Sometimes it wouldn't work so Elmo would mess around with his equipment and try something new. We tried putting the antennas up higher and that helped a lot. We tried vertical wires, horizontal wires, longer wires, and shorter wires to see what effect they would have. Vertical and longer were better. Then we hit the wall again and Elmo tried connecting a ground rod to the receiving and transmitting apparatus and that helped a lot, too.

Finally, after a lot of trial and error, we set up the receiving apparatus in the field about a half a mile away, and Elmo's brother, Alfonso, was able to detect our signal. Rossa and Righi congratulated Elmo on reaching "the limit." You see, the famous English scientist, Oliver Lodge, had told Righi that one-half mile was the maximum distance the waves could travel and that's what Rossa believed, too. But Elmo and I were playing the distance game and decided to push on until we couldn't detect a signal anymore. Elmo didn't care about what the scientists said. In his imagination, he was connecting the world and his messages could travel everywhere.

Eventually, he got it working over a mile ... way beyond what anyone thought he could do. That's when he showed me how big he was thinking. He went to his dad with a bunch of ideas about how wireless could change the world. All he needed was more power, bigger antennas, and better equipment. In other words, a lot of money. His dad was impressed enough to introduce Elmo to some of Italy's most important government and business figures, hoping to get him some backing. Elmo offered his inventions to the Italian navy, too. But, nobody in Italy was willing to back him. He got pretty discouraged. That's when his mom suggested that maybe the Jamesons could help him.

The Whiskey Connection

Elmo's mom, Donna Anne, being the granddaughter of the founder of Jameson whiskey, had lots of wealthy relatives in Ireland and England and figured one might be willing to sponsor Elmo. So, she took us to England where he presented his ideas to the family, the bankers, and even the British government. Of course, they all wanted a demonstration, which we gladly provided. By then we had the distance up to four miles. When they saw what we could do, some of them could see where things might lead and signed on to fund Elmo's company, The Marconi Wireless Company. That was 1896. We were just 21 years old.

Well, the rest of the story everybody knows. He kept on playing the distance game, breaking records every month. Elmo was always ahead of the scientists who had to play catch-up and devise new theories to explain the impossible. When he broke the 12-mile barrier, the post office, the navy, and the bankers all got very excited as the possibilities finally became crystal clear. Then they said he couldn't go farther than 200 miles because of the curvature of the earth, but he proved them wrong again. Finally, in 1901, he made the first wireless contact between North America and Europe, spanning the Atlantic Ocean, making the front page of newspapers around the globe. Elmo's fame was unparalleled which resulted in a lot of public adulation, including from the ladies, as he was still a bachelor at that time.

A New Age

Wireless would connect the world and usher in a new era of civilization, just as he had imagined, and the Marconi Company would be at the forefront. Elmo cleverly set it up as a service company. It didn't sell equipment but instead leased it, along with trained operators. Some of the first customers were the ocean liners because the passengers wanted to send telegrams but were totally out of touch for weeks at a time when at sea. When the Titanic disaster happened, without the Marconi operators aboard, there likely would have been no survivors. The Marconi Company and its wireless operators were hailed as heroes and shipboard wireless was deemed a public necessity. More orders rolled in.

Italy had long since recognized the importance of its native son and now it, indeed the world, poured on the honors. He was ennobled as Marchese by the King and elected a Senator. He was made a commander of the Navy. He was even awarded the Nobel prize in physics for boldly defying scientific convention and emerging a winner, which was a stunning accolade because he considered himself more of an entrepreneur than a physicist.

I was not surprised at all by these accolades. Elmo relentlessly pursued his vision overcoming every obstacle. Radio communication was, by then, recognized as one of the most important technical advancements in the history of the world. Elmo was idolized the world over. Mothers and fathers of teenage boys encouraged their sons to learn the art and science of wireless. Given Elmo's youthful appeal, it didn't take much encouragement. Radio was an exciting game and its popularity exploded.

Eventually, the boys made such a racket on the airwaves that some governments decided to crack down and create some order out of the chaos. There was even some talk in America about banning the unruly "hams" altogether, but Hiram Percy Maxim of the ARRL stood up against that. Elmo, being friends with Maxim, backed him but wanted the hams moved up in frequency and out of his precious long wave bands. That's what happened, and you know the rest of the story. The hams got lucky.

Back in Italy

My life since those magical early days has been pretty dull, actually. I could have stayed with the company but I got homesick and returned to Pontecchio, got married, and settled down. I haven't lost any of my excitement for radio communication, though. I am a ham myself, now. I have my own apparatus here at home and making shortwave radio contacts is my favorite pastime. Elmo and I kept in touch with each other through the years, often by radio. In fact, he installed a wonderful laboratory on his yacht, Elettra, and was playing the distance game right up to the end, exploring the potential of microwaves.

Now, let me pour you another drop of Jameson and I'll tell you all about his glamorous girlfriends...

Announcing: The 2020 CQ World Wide WPX Contest

SSB: March 28-29, 2020 CW: May 30-31, 2020
Starts: 0000 UTC Saturday Ends: 2359 UTC Sunday

The CQ World Wide WPX Contest is the world's largest everyone-works-everyone radio contest.

Two new overlay categories are available this year: Classic Operator for single ops using one radio and no spotting, and Classic Multi-One, for those who want to share just one radio. See the complete rules for more details.

Contest Basics

Each contest mode is a separate event running from 0000 UTC Saturday until 2359 UTC Sunday. SSB is the last full weekend of March and CW is the last full weekend of May.

Amateurs worldwide try to contact as many amateurs and prefixes as possible during the period of operation. Single Operator stations may operate 36 of the 48 hours — **off times must be a minimum of 60 minutes** during which no QSO is logged. Multi-operator stations may operate the full 48 hours.

Contacts are only valid on the 1.8-, 3.5-, 7-, 14-, 21-, and 28-MHz bands (no WARC bands). Exchange an RS(T) report plus a progressive contact serial number starting with 001 for the first contact. Note: Multi-Two and Multi-Unlimited entrants use separate serial number sequences on each band.

Scoring

The final score is the result of the total QSO points multiplied by the number of different prefixes worked. A station may be worked once on each band for QSO point credit.

Contacts with your own country are worth one point on each band. Contacts between stations on different continents are worth three points on 28, 21, and 14 MHz and six points on 7, 3.5, and 1.8 MHz.

Contacts between stations on the same continent, but different countries, are worth one point on 28, 21, and 14 MHz and two points on 7, 3.5, and 1.8 MHz. Exception: For North American stations only — contacts between stations within the North American boundaries (both stations must be located in North America) are worth two points on 28, 21, and 14 MHz and four points on 7, 3.5, and 1.8 MHz.

The prefix multiplier is the number of valid prefixes worked. Each prefix is counted only once regardless of the band or number of times the same prefix is worked Special event, commemorative, and other unique prefix stations are encouraged to participate. **A station operating from a DXCC entity different from that indicated by its callsign is required to sign portable**. Prefixes must be **issued or permitted** by the licensing authority of the country of operation. See the full rules for a description of what constitutes a prefix.

Entry Categories

The competition is divided into Single Operator and Multi-Operator categories. Single Operators may also enter an Overlay category.

Single Operator (all bands or any single band): Only the one operator finds, makes, and logs all contacts. If you want to use a DX spotting network or CW decoder, enter the Single Operator Assisted category, below.

- High power: Up to 1,500 watts
- Low power: 100 watts or less
- QRP: 5 watts or less

Single Operator Assisted (all bands or any single band): the one operator may use the DX Cluster or other tools to help find contacts. **The one operator must make and log all contacts**.

- High power: Up to 1,500 watts
- Low power: 100 watts or less
- QRP: 5 watts or less

Single Operator Overlay Categories: Entrants in Single Operator categories may also submit their log for one of the overlay categories shown below. No distinction is made between assisted and unassisted in the overlay categories. All Overlay entries are grouped into high power and low power in the results.

Tribander / Single Element Overlay: During the contest an entrant shall use only one tribander (any type, with a single feed line from the transmitter to the antenna) for 10, 15, and 20 meters and single-element antennas on 40, 80, and 160 meters. Separate receiving antennas are not allowed in this category.

Rookie Overlay: To enter this category the operator must have been licensed as a radio amateur three years or less on the date of the contest.

Classic Operator Overlay: Operate using only one radio and no QSO finding assistance.

Multi-Operator Categories (All Band only): More than one person can contribute to the final score during the official contest period.

Single-Transmitter: Only one transmitted signal is permitted at any time. The station may change bands up to 10 times per hour. This category has specific restrictions on band changes so please read the full rules carefully.

- High power: Up to 1,500 watts
- Low power: 100 watts or less
- Classic Overlay: use only one radio during the contest

Two-Transmitter: Two bands may be transmitted on simultaneously. Each station may change bands up to 8 times an hour.

Multi-Transmitter (Unlimited): One transmitted signal is allowed on each of the six contest bands.

Checklog: Entry submitted to assist with the log checking. The entry will not have a score in the results and the log will not be made public.

Awards

Electronic certificates will be made available for download for everyone that submits an on-time entry. Plaques are awarded to recognize top performance in a number of categories. The current list of plaques and sponsors is at <www.cqwpx.com/plaques.htm>.

Club Competition

Many clubs around the world compete vigorously for the plaque awarded to the club making the highest total combined score in the SSB and CW weekends.

Submitting Your Log

Electronic logs should be in the Cabrillo format. Upload your log on the web at <www.cqwpx.com/logcheck>. The website also includes a utility to convert your ADIF format log file if needed. See full rules for instructions regarding paper logs.

All entries must be emailed or postmarked **WITHIN FIVE (5) DAYS** after the end of the contest: SSB logs no later than 2359 UTC **3 April 2020**, CW logs no later than 2359 UTC **5 June 2020**. Any log submission will replace any previous submissions. Resubmitting an entry after the deadline will result in it being considered as a late log.

Full Rules Online

Complete rules are available in several different languages at <www.cqwpx.com/rules.htm> and in English only on *CQ* magazine's website.

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

If it's Not Broken, Don't Try to Fix It

The new year is upon us and to paraphrase an old expression, "this is the future, today, that you dreamed about in the past." What have you done to get to this point regarding amateur radio? Have your hopes and dreams regarding radio actually been fulfilled?

I would like to start the column this month with somewhat of a continuation of last month's column. You will remember that I suggested looking ahead but now, along those lines, I would like to share a story or two.

I once had a technician who was a very up-to-date individual (or so he thought) and who was obsessed with technology. Anything more than a year or so old was considered an "antique" by him and not worth his time. Well it turns out that we were in the process of developing a wireless transmitter and receiver for analog video transmissions and we needed to look at a particular wave shape in a circuit that might be the cause of a distorted picture. Our company had a number of older Tektronix 545 oscilloscopes on carts and one new digital scope we had just acquired that was 1/10th the size and, of course, solid state. My tech indicated that he could not really make a proper measurement right away since the digital scope was in use by another engineer. "I would get a much better look at the wave shape with the new scope" was his excuse. "Solid-state devices are far superior to, ugh, old-fashioned vacuum tube-based instruments," he continued.

You might think this was a joke but he was quite serious. My answer was simply that I did not really care what was inside the box, how big it was, or what powered it as long as it would display a 5-MHz wave shape properly. The "old" 30-MHz scope was obviously overkill but he did not (or did not want to) consider it. In a similar manner, an amateur who visited my home QTH a while ago could not believe that I used a Kenwood TS-830 "boat anchor" and matching panadapter with an (oh my God) cathode ray tube that had to actually "warm up" before it could be used. His ultra-modern rig, complete with all kinds of colorful digital displays and graphs, automatic band loading and instant on, was certainly "where it was," not the past. The fact that practically anyone I try to contact with my "antiques" usually gets back to me with excellent reports did not seem to matter to him. I wonder if he would use "Alexa" or "Siri" to scan the bands for him if "they" could. In fact, maybe *he* was what was actually obsolete and the software and artificial intelligence (AI could [or would] eventually even replace him).

That is my point. Absolutely look forward, but never forget that the future is built on the foundation of the past. Don't throw out something (literally or figuratively) if it is not "up to date." It may be perfectly useful for your current needs. Don't get me wrong. Artificial intelligence and related software are definitely the way our technology is progressing and I am as amazed and intrigued as anyone, but I am also well aware of the past. If you understand the basics, you will go a long way toward enjoying amateur radio and solving some of the technical problems that come up from time to time. You will also gain an understanding of how things develop over time.

With that thought in mind, if you are truly forward-looking, certainly continue to do so but also scan the want ads and eBay and similar sites to discover what is available from the past. Often you will find equipment that works as well (or even better) than that super rig you are salivating over (and at a fraction of the cost). Yes, you might have to read a meter with a physical pointer or adjust a tuning or loading capacitor control knob but isn't that what the true *amateur* experience really is?

I have a copy of an old CQ publication called the "*Surplus Schematics Handbook*." It has the schematic diagrams of many items of WWII radio equipment previously in use and then available to experimenters. To browse through its pages is very interesting as it shows the beginnings of things to come. There are obviously no transistors or integrated circuits and only a single diode in a field strength meter but all of the equipment helped win the war. Transmitters producing hundreds of watts using vacuum tubes and covering all amateur bands (along with military frequencies) were plentiful as were matching receivers. Some of these were fixed station units and others were units that could be used as mobile rigs with unique vibrator and dynamotor (motor-generator) power supplies. The well-known BC-611 walkie-talkie of the time, for example, was the forerunner of the HT and cell phone and here it was, in a "compact" handheld device compete with vacuum tubes, microphone, speaker, and batteries as well as a push to talk switch and integral antenna. True, it only operated on a single frequency in the 3 to 6-MHz region, but I had occasion to experience one (on 80 meters) over a 1/2-mile path and, although it was AM, the two-way signals were copied with no problem at all. Not bad for the 1940s.

Other equipment described demonstrated techniques and equipment that would become commonplace years later such as FM, frequency meters (not with digital displays but using heterodyne techniques), radio-controlled devices, teletype machines (with keyboards but not computers) and all kinds of microphones and headsets, not to mention wire and whip antennas. Often the circuits were clever and outgrowths of the techniques developed then are the basis of those used today.

Without continuing to bore you, if you can get a hold of this or similar publications (some of which are available online) or even have the opportunity to actually look at some of this equipment, you are in for a surprise. You will find it quite informative as to what was and still can be done with "antique" equipment by clever people — even today.

Once again, the very best for the coming year and may all of your wishes and dreams come true in 2020.

– 73, Irwin, WA2NDM

**c/o CQ magazine*

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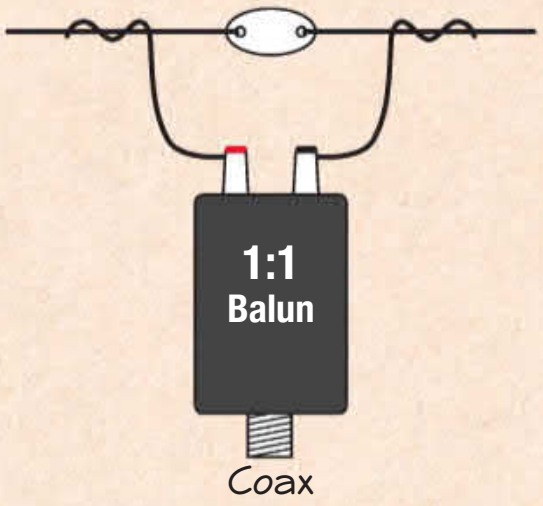
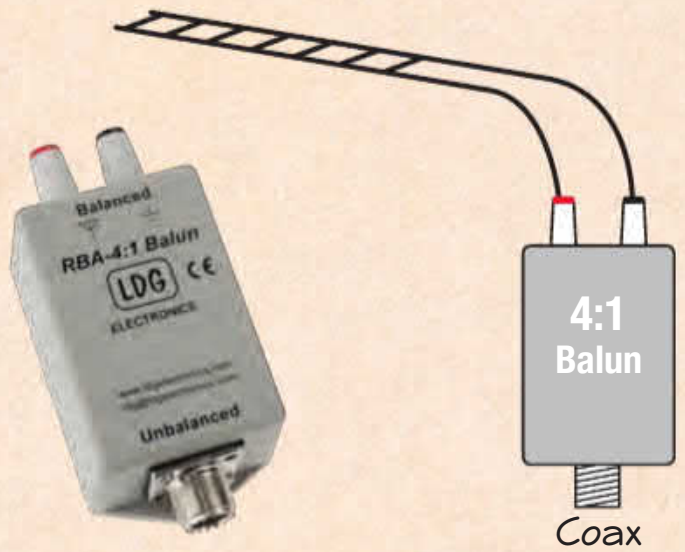
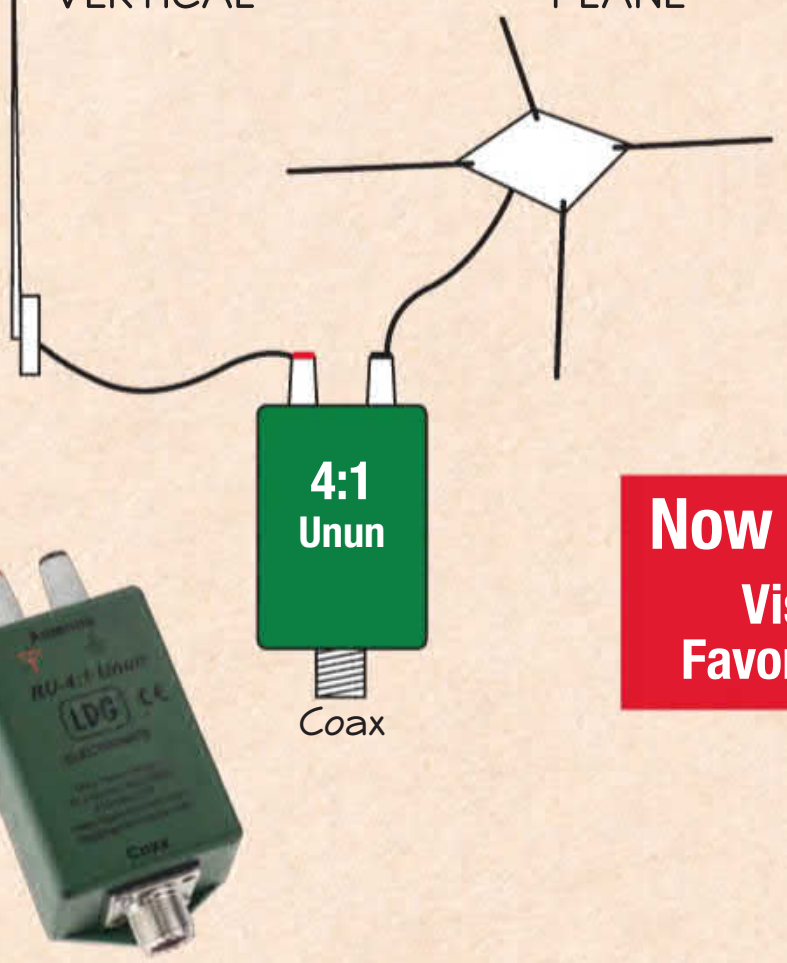


LADDER LINE/TWIN LEAD



18' THRU 43' VERTICAL

GROUND PLANE



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THE LISTENING POST

BY GERRY DEXTER

New Station in Chile Relays News of Unrest

~ A new Chilean station (likely unlicensed –*GLD*) is Radio Compania Worldwide, based in the town of San Francisco. It used 6925 kHz from 2200 UTC and relayed Radio Bio Bio (620 on Medium Wave) in Concepcion. The shortwave outlet replayed the broadcast of Radio Bio Bio's news of the political / social crisis currently occurring in Chile and likely was temporary and probably used very low power.

~ Radio Congo (Republic of) has been noted in California at 0540 UTC on 6115 kHz with programming already in progress; it was scheduled from 0500-0600 UTC. I don't think anyone in the Midwest has ever reported that one to the Post. Why don't you give it a shot?

~ Echo of Hope … (Echo of Hope) has a new shortwave schedule: 0100-0500 UTC on 4885, 6250, and 9100 kHz; 0500-0900 UTC on 3985, 5995, 6350 kHz; 0900-0100 UTC on 3985, 4885, 5995, 6250, 6350, and 9100 kHz all in Korean, although an "Easy English" feature is scheduled at some of those hours. (Echo of Hope is an opposition broadcaster transmitting from South Korea to the North. –*GLD*)

~ Eye Radio has resumed shortwave transmissions. The anti-South Sudan broadcast is transmitted via France and the Vatican at 1600-1700 and 0400-0500 UTC on 15410 and 7340 kHz, respectively. (The broadcast originates in Juba, South Sudan. –*GLD*)

~ The Voice of America, through USA's Global Media (USAGM), has contracted to design, install, and test a new antenna system for its Kuwait shortwave relay. The new antenna would increase USAGM's coverage to Africa for the VOA and the other US users.

~ Radio Northern Star, a fairly new kid on the on the shortwave block, is operating from 1300 UTC (1400 UTC on Sundays) on 5895 kHz. Reports can be submitted electronically to <northernstar.no>. Postal mail should go to P.O. Box 1000, N-5331 Rong, Norway. The station wants you to include $3 to pay for a paper QSL. By the way, it doesn't use a lot of power, usually just 250 watts or less.

~ Progress in eastern Europe: Work at Radio Romania International's relay at Tiganesti has been completed. Apparently work continues at the Galbeni site.

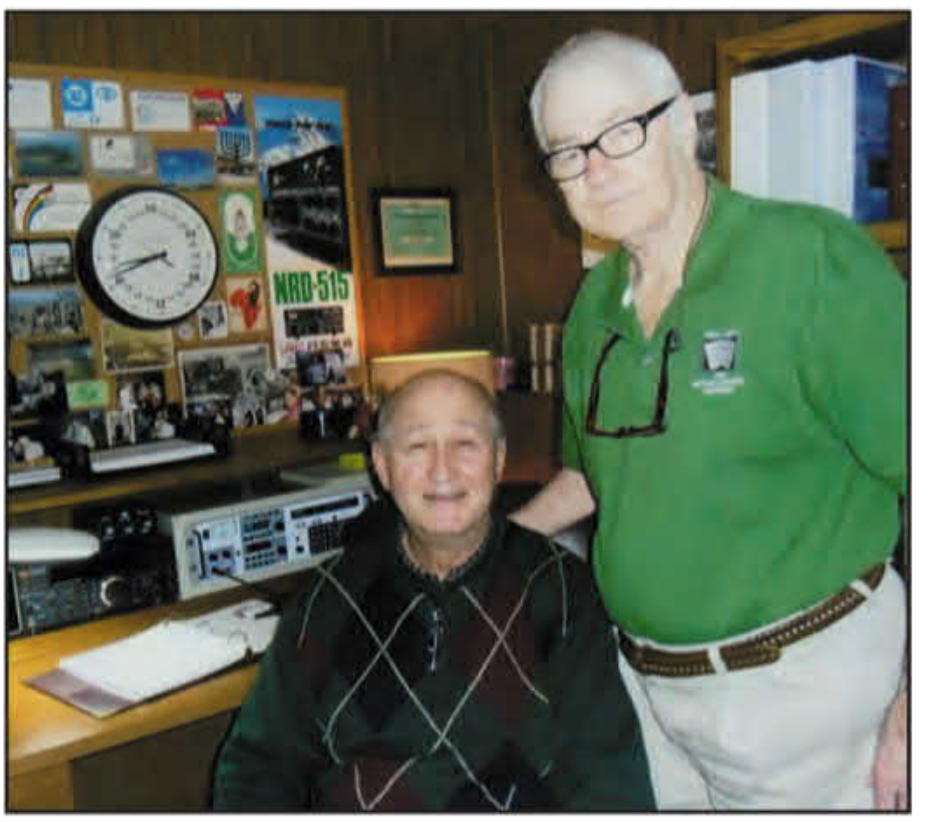
~ Australia's Unque Radio (5045 and 3210 kHz), in Gunnedh, New South Wales, is off the air due to technical problems. The folks there rather cavalierly approached these issues, saying the fix would be attended to "as time permits." And would "let us know" when they got back in the air.

~ If you happen to stumble across a "Radio For Peace International" (RFPI) one of these days, relax … you haven't stepped into a time warp. This RFPI has no connection with the old RFPI, which used to operate from Costa Rica. The freshly-minted RFPI is relayed by WRMI on 5955, 6070, 9395, 9955, 15770, or 21525 kHz and occasionally by WBCQ (5130 kHz).

Reader Logs

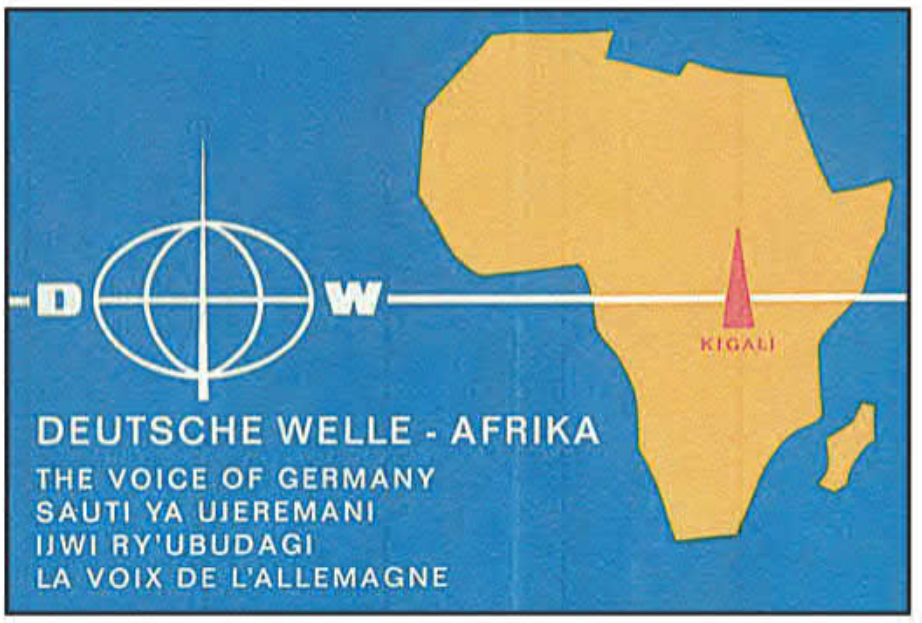
Remember, your shortwave broadcast station logs are always welcome. But *please* be sure to double or triple space between the items, list each logging according to the **station's home country**, and include your last name and state abbreviation after each. Also needed are spare QSLs, station schedules, brochures, pennants, station photos, and

Those call letters have been around almost forever and still apply to Radio Thailand, now heard through the American USAGM site at Udon Thani with seven transmitters pumping out 500 kilowatts each. (Courtesy of Bob Brossell)



Ralph ("Ralphus") Perry in a visit to the Listening Post. He's the one on the left. The other guy?

**c/o CQ magazine*



Deutsche Welle's former relay site in Kigali, Rwanda. Now long gone just like the rest of them. (Thanks Bob Brossell)

Here's another Brossell QSL. This one from Radio Cairo. (Courtesy of Bob Brossell)

anything else you think would be of interest. The same holds for you amateur radio operators who also listen to shortwave broadcasts … I know you're out there. You, too, are also most welcome to contribute!

Here are this month's logs. All times are in UTC. If no language is mentioned English is assumed.

ARGENTINA—**RAE**, 7780 via Okechobee at 2352 in French and multi lingual IDs, 2359 with Bob Zanotti and WRMI ID at close. (D'Angelo, PA)

ASCENCION—**BBC-North Atlantic Relay**, 15490 in Hausa at 2003. (Brossell, WI)

BHUTAN—**Bhutan Broadcasting Service**, Thimptu, 6035 at 0158 with usual signature melody and ID at 0200 and into programming. (Goonetelleke, Sri Lanka)

BOLIVIA—**Radio Mosoj Chaski**, Cochabamba, 3310 at 1023 with local / romantic music and man speaking in Quechua. (Taylor, WI)

BOTAWANA—**VOA Relay**, 4930 with news at 0301 on 6080 with news and *Daybreak Africa* at 0303, 15580 beginning news at 2100. (Sellers, BC) 1725 in Amharic. (Brossell, WI)

BRAZIL—(all in Portuguese –*GLD*)

Radio Educacao Rural, Tefe, 4925 at 0151, male and female announcer, into theme-like music, possible ID at 0200, then the same man and woman alternating with possible news items. (Taylor, WI)

Voz Missonara, Camboriu, 5940 at 0245 with talk and a hymn, 9665 at 2156 and man with fairly mellow talk and music. (Taylor, LFP)

Radio Aparecida, Aparecida, 6135 at 2340 with local vocals and woman hosting romantic ballads. (Taylor, LFP)

Radio Nacional Brasilia, 11780 with several mentions of "Nacional" at 2225. (Brossell, WI)

CANADA—**Bible Voice**, 9490, possibly via Kostinbrod (Bulgaria) at 1757 in Arabic with man giving an address, HOA music and off at 1800. (Taylor, WI)

CHINA—**China Radio International**, 9590, Kashi in Spanish at 2315, 9675 via Shijizhuang in Russian at 1326, 11990 via Jinhua with instrumental music and announcements in Sinhala. (Brossell, WI)

China National Radio, 6080, Ge'ermu in Mandarin at 2332, two men talking with musical bridges; 6090, Ge'ermu at 2335 with female / male announcers also in Mandarin. (Taylor, LFP)

PBS Xinjiang-Urumqi, possibly on 5900 at 2326 in Mandarin with female / male announcers. (Taylor, LFP) 6190, Urumqi in Mongolian with male announcer at 1227. (Taylor, WI)

EGYPT—**Radio Cairo**, 9895 in French at 2010, followed by Qur'an recitations. (Brossell, WI)

ENGLAND—**BBC**, 11875, Woofferton in French at 1816. (Brossell, WI)

ESWATINI (Swaziland)—**Trans World Radio**, Manzini, 13580 at 1614-1627 approximately with religious talk in possibly Kirundi, music at 1625 and apparent close. (D'Angelo, PA)

FRANCE—**Radio France International**, 9635, Issoudun at approximately 1900-1912 opening as soon as Radio Ndarason closed with two announcers in French, station IDs and into French service. (D'Angelo, PA) 13635 at 1726 in French. (Brossell, WI)

GUATAMULA—**Radio Verdad**, Chiquimula, 4055 at 0205 with hymns and Spanish announcements. (Brossell, WI)

GUINEA—**Radio Guineenne**, Conakry, 9650 in French at 2029 with hi-life and an "ici Guinee" station ID. (Brossell, WI)

INDIA—**All India Radio**, Vividh Bharati service, 9865 at 1135 in Hindi with Southeast Asian music; 9880, Bengaluru at 1249 in Hindi with Indian film music and man / woman duet. (Taylor, WI and LFP) 15040, Benglaruru at 1259 with talks in Mandarin and time pips at 1300. (Brossell, WI)

IRAN—**VOIRI**, 6155, from possibly Zahedan at 2355 with woman speaking in Arabic at length. (Taylor, LFP)

MADAGASCAR—**Madagascar World Voice-Light of Life Radio**, 11610 in Mandarin at 2120. (Brossell, WI)

Madagascar World Voice-Radio Feda at 11790 with young girl speaking and apparent man answering. (Brossell, WI)

MALI—**Radio Malienne**, Bamako, 5995 at 2151 in Bambara with local guitar and male announcer. RHC opened at 0000 knocking Mali out. (Taylor, LFP)

NORTH KOREA—**Korea Central Broadcasting Station**, 11680 from possibly Kaggye at 2210 in Korean with woman speaking at length and the usual DPRK strident tone. (Taylor, LFP)

OPPOSITION—**Radio Ndarson International** (UK to Chad), 9635 via Wooferton, 1810 at 1810-1859 approximately with group vocals, man speaking in Anuri, others soon joined in, musical numbers between talk sections. Nice ID at close. (D'Angelo, PA) 9775 at 1846 in Kanuri,

man reading canned station ID, man giving Arabic sound bite. (Taylor, WI)

Echo of Hope (South Korea to North), 9355 at 2223 woman speaking in Korean with pop music. (Taylor, LFP)

Denge Welat (via France to Turkey) 11530 at 1533 with program of regional instrumental music, seemingly on an old frequency instead of the new 11540 At 1430, 11540 seems to be still active with nice vocals and periodic talks in possible Kurdish. No sign of the Turkish jammer known as Radio Recep Erdogan. (D'Angelo, PA)

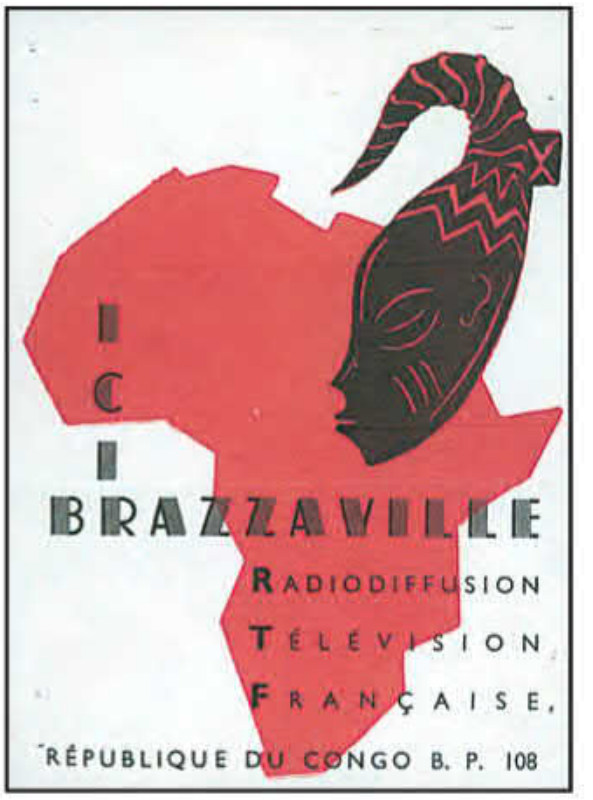
MALI—Radio Mali, 5995, Bamako at 2250 with exotic strings, harp, piano, and French talks. One of the earliest signals on the band. (Perry, IL)

PERU—Radio Tarma, Tarma, 4775 at 1026 with mellow instrumental music, station ID, commercials, and a man giving a speech in Spanish. CODAR ruined an otherwise fair signal. (Taylor, WI) (Radio Tarma is reported to be using a new {temporary} 2-kilowatt transmitter. –*GLD*)

PHILIPPINES—Radio Veritas Asia via Vatican, 9700 possibly at 0010 in Kachin with man giving a sermon. (Taylor, LFP)

PIRATES—Underdog Radio, 6925 (USB) at 0041 with a variety of American pop music, SSTV, a country thing, later SSTV of a dog and cat fight, then four more undecoded SSTVs. **Mix Radio International**, 6916 (USB) in Portuguese at 0022 with mellow contemporary dance things, eventual station ID between numbers. **Wolverine Radio**, 6950 at 0017 with New Orleans jazz, rock number, station ID after every third number and "true"-themed songs, later into "white"-themed songs, SSTVs at 0042 and 0123. **WTF Radio**, 6960 at 2349,

I used to listen to this one in English every afternoon after school. Back then they were still in French Equatorial Africa.



hard rock with number station "call up" and a few number groups between each, said broadcasting from the East Coast, off at 0000. **Damn Skippy**, 6925 (LSB) at 0132 with a series of SSTV, some of which were not decipherable and pesky talking throughout, switched to USB around 0200, more SSTV with same themes, some of them Star Trek related, then off at 0229. **Skunk House Radio**, 6951 (USB) at 2146 with rock, ID, into Beatles, abruptly off at 2200. (Taylor, WI)

Underdog Radio, 6925 (USB) at 0145, weak, barely heard music, SSTV / FAX at 0206 and 0209. **Pee Wee Radio**, 6955 (USB) at 0017 with progressive rock, SSTV / FAX, then country, another SSTV at 0022. **Radio Free Whatever**, 4185 at 2236 with DJ Dick Weed and heavy metal, Halloween-themed tunes, and posts from HFU, seemed to go off at 2355. **Brownie Radio**, 6965 (USB) at 2354 weak under storms, apparent NA at 2356, man with muffled talk underneath, various Interval signals, station ID from HFU. **Wolverine Radio**, 6960 (USB) at 0005 with Halloween tunes, SSTV / FAX at 0056, second set at 0058. **XFM**, 4185 very weak at 0154 with man talking. (Hassig, IL)

ROMANIA—Radio Romania International, 6040 at 0306 with woman talking and frequency announcement, then news. (Sellers, BC) 9760 at 2230 with English station ID and instrumental music. (Brossell, WI)

SAO TOME—VOA Relay, Pinheira, 4960 at 0523 in Hausa with seeming news and actualities. (Taylor, WI)

SAUDI ARABIA—BSKSA, 9675 in Turkish at 1928. (Brossell, WI)

SRI LANKA—SLBC, 11905 via Trncomalee, at 0030 to 0058 and 0200-0230, both in Hindi (the other hour is used for a paid client). Also 9695 at 1115-1158 in South Asian vernaculars. (Goonetelleke, Sri Lanka)

TAIWAN—Radio Taiwan International, 9660 in Mandarin at 1420. (Brossell, WI)

TURKEY—Voice of Turkey, 9635, Emirler at 2054-2119 with Turkish music, French service, and numerous station IDs and Tukish vocals. (D'Angelo, PA) 9860 at 2217 with facts and fallacies about Turkey. (Brossell, WI)

UNITED STATES—Voice of America, 15110-Thailand Relay in Mandarin at 1308, 15620-Woofferton with talks in Somali at 1620. (Brossell, WI)

Radio Free Asia, 15275 via Tajikistan in Tibetan at 1338. (Brossell, WI)

RFE/RL-Radio Liberty, 15255 via Woofferton in Tajik at 1402. (Brossell, WI)

Radio Farda, 12005 via Woofferton at 1301 and 1753, both times in Farsi with U.S. style dance music. (Taylor, WI)

Adventist World Radio, 15480 via Nauen in Mandarin at 1419, 9900 via Guam at 0430 in Mandarin (Brossell, WI)

WWV / WWVH, 2500 at 1141 both here with time announcements. WWV was barely audible on its other frequencies. (Taylor, WI)

WJHR, Milton, Florida, 15555 with a preacher at 2039. (Sellers, BC)

Overcomer Ministry, 6055 via Bulgaria at 0133, Brother Stair with the usual stuff. (Taylor, WI)

Radio Tirana, 15770 via WRMI at 2034. News, then a feature on the Albanian economy. (Sellers, BC)

VATICAN—Vatican Radio, 7305-SMG at 0100 in Portuguese with IS, station ID and man reading the news. (Taylor, WI) 9705 in French at 2036. (Brossell, WI)

VIETNAM—Voice of Vietnam, 12020 from possibly San Toy at 1302 in Indonesian with barely audible female announcer. (Taylor, WI)

ZAMBIA—NBC Radio One, 5915 at 0139 in Lunda, man was barely audible on peaks. (Taylor, WI)

Quien Sabe (Who Knows?)

~ A German monitor reports an unidentified Arabic station on 7315 kHz (specifically 7314.98 kHz) at 0135-0214 UTC, perhaps from the Sudan / Somaliland area.

~ But that's not all! Steven Wood in Massachusetts notes an unid on 11815 kHz in a central Asian language around 1430 UTC with ballads, ad streams, and a tentative station ID as "Radio Dinst".

QSL Quests

Radio Free Asia is still at it. They've announced the release of their 71st QSL card design, this one to mark their 23rd anniversary and good for replying to reports from September through December 2019. Maybe a special request would still produce one.

Back in the Day

Radio Emissora Reyes, Reyes, Bolivia, in Spanish at 0208 on June 23, 1983 with their domestic service.

Just Sayin'

Up until now, I've been dividing the logs, putting the best / most interesting ones first, then the other logs are placed on the *CQ* Listening Post blog. Now *CQ* has changed its policy and so from here on, all of the "Listening Post" logs will be in the print column. Yippee!

Thanks for Your Logs

High fives and back slaps to William Hassig, Mt. Pleasant, IL; Mark Taylor, Madison, WI and LFP Lake Farm Park, near Madison; Ralph Perry, Wheaton, IL; Harold Sellers, Vernon, BC; Bob Brossell, Pewaukee, WI; Rich D'Angelo, Wyomissing, PA; and Victor Goonetelleke, Sri Lanka.

Until next month … Keep on keepin' on, and ... Celebrate Shortwave!

EMERGENCY COMMUNICATIONS

BY WALT PALMER,* W4ALT

Fire, Fire, Ring the Bell!

The recent wildfires in California caused great angst and heartache for many in or near their paths. Homes were lost to fire. Pets and livestock perished. Some lost all but the shirts on their backs. Photographs and news footage told only part of the story. The most powerful image for me was of the Ronald Reagan Presidential Library in Simi Valley, as the Easy fire approached the 100-acre compound where the President and First Lady are buried, and the library houses SAM 27000, the presidential Boeing 707 aircraft that flew presidents and VIPs from 1962 to 1998. While working for a major alphabet TV network, I covered the White House and was fortunate to ride that very same 27000, callsign Air Force One.

As the fires raged (*Photo A*), Pacific Gas and Electric (PG&E) turned off power to areas where gusty winds and dry conditions heightened the fire risk. This affected over 1 million customers in 13 counties, many in rural areas. Millions of dollars in perishable food was lost due to refrigeration failure. People also lost the ability to communicate as both landline and wireless phone systems failed. As cellular systems fell offline, personal cell phones lost battery power rapidly as they searched for a signal. Some people thought it wise to charge their phone batteries from their car batteries. While the practice seems like a great idea, it caused many auto batteries to fall below starting amperage. For those with electric cars, driving range suffered by using the now precious power for other uses.

Communication Issues

Public communications in affected area were reduced to three sources: Broadcast radio, face-to-face and, of course, amateur radio. Broadcast radio worked only if the transmitting stations had emergency power generation with sufficient fuel, but it required listeners to have use of mechanical, solar generation or batteries to power their receivers.

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A Historic Note

On December 23, 1900, Reginald Aubrey Fessenden sent and received the first intelligible speech by electromagnetic waves on a pair of masts 50 feet high and one mile apart on Cobb Island, Maryland. Fessenden was using a spark transmitter with the Kintner-Brashear interrupter. A fascinating biography of Fessenden is available on Wikipedia at <https://tinyurl.com/jgl857p>.

A fun article in a 2000 edition of the *Washington Post* discusses Fessenden and the recreation of the then 100-year-old radio event by a local radio club. See <https://tinyurl.com/wyk2gc3>.

Photo A. Electric power and communications are among the early casualties of wildfires in California... sometimes even before a fire breaks out! This 2017 photo shows a wildfire in Napa County, California. (US Air Force photo by Keith Johnson)

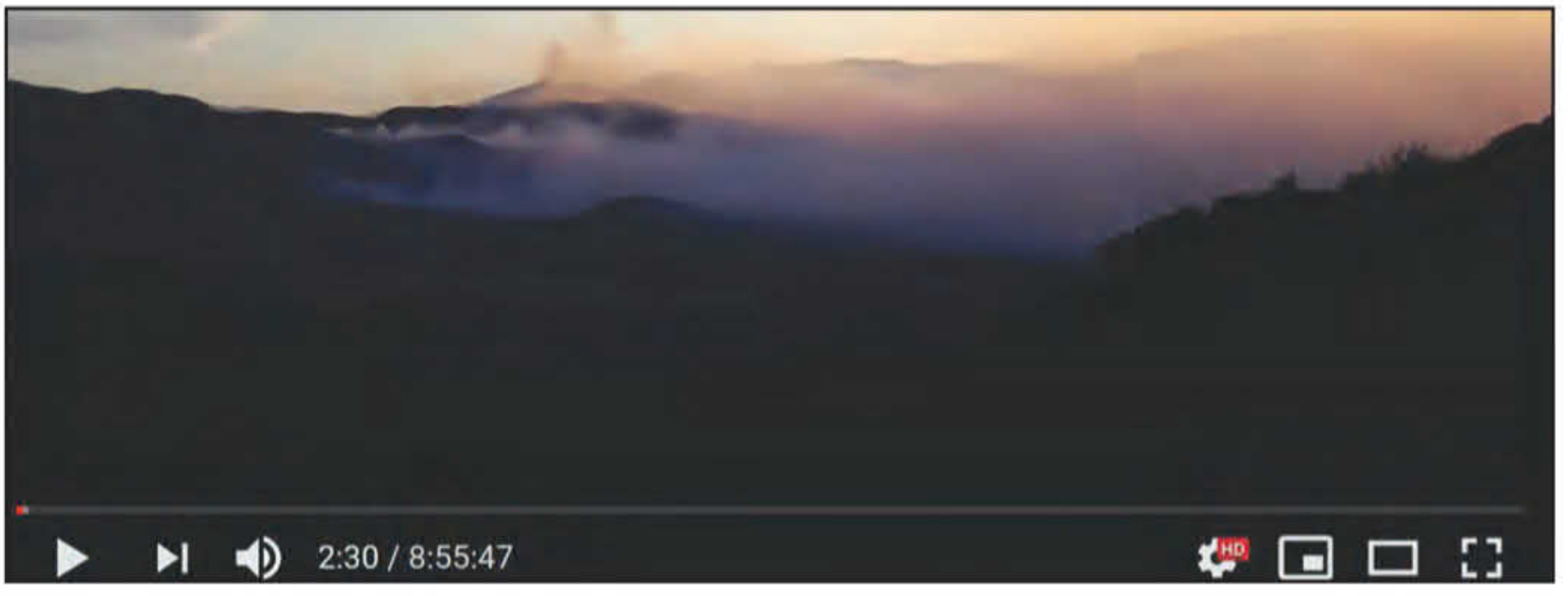

Photo B. Screen grab from the livestream of California's Saddle Ridge fire transmitted via AREDN by the Pleasant Valley Amateur Radio Club (PVARC). As you can see, this particular livestream ran nearly nine hours. The full video is on YouTube at <https://tinyurl.com/qna4e8y>.

Emergency Communications Preparedness Center

The Emergency Communications Preparedness Center (ECPC) is the federal interagency focal point for interoperable and operable communications coordination. Its members represent the federal government's broad role in emergency communications, including regulation, policy, operations, grants, and technical assistance.

The ECPC is comprised of 14 federal departments and agencies: U.S. Departments of Agriculture, Commerce, Defense, Energy, Health and Human Services, Homeland Security, Interior, Justice, Labor, State, Transportation, and Treasury. The Federal Communications Commission and the General Services Administration are also members of the ECPC. Learn more about the ECPC at <https://tinyurl.com/wp3knzt>.

Two amateur radio groups used their knowledge of the Amateur Radio Emergency Data Network (AREDN) <www.arednmesh.org> to monitor wildfires in California. The Mariposa Area Amateur Radio Organization (MAARO) used the AREDN mesh to livestream video from the Briceburg Fire near Yosemite National Park <https://tinyurl.com/up5vg47>. The Pleasant Valley Amateur Radio Club (PVARC) built an AREDN mesh to livestream video from the Saddle Ridge Fire from a repeater site serving the San Fernando Valley <https://tinyurl.com/qna4e8y> (see *Photo B*).

Use of AREDN is not a new technique. The following is from the AREDN website from the 2018 fire season:

California Hams Provide Fire Videos
Local amateur radio operators are responding to the recent and ongoing fires in California in many ways. Several of these hams have built a high-speed multimedia AREDN mesh network which was used to deliver live streaming video of the fires in progress.
In Ventura County, Orv Breach W6BI, Paul Straus WD6EBY and Ben Kuo AI6YR installed high-definition cameras in their portion of the growing Southern California AREDN network. They were able to figure out how to send to live video stream across the mesh network to then Internet and finally to YouTube for public access.
Ben AI6YR reports that their mesh network stayed operational even when the Spectrum cable, Internet access and phone system went down across the region. People were able to use the mesh network to keep updated on emergency information.
The start of the "Woolsey Fire" from Simi Valley, courtesy of Orv W6BI and the Pleasant Valley Amateur Radio Club <https://tinyurl.com/sepyoyp>.
The fire in Santa Paula, California (Briggs Fire), courtesy of Paul WD6EBY and the Pleasant Valley Amateur Radio Club <https://tinyurl.com/sgum5a7>.
The fire in Simi Valley, The Peak Fire, courtesy of Orv W6BI and the Pleasant Valley Amateur Radio Club <https://tinyurl.com/uw7kmdq>.

Note the length of some of these videos, proving the resilience and reliability of amateur radio and AREDN technologies.

Sacramento Valley Section Regional ARES reported over 1,800 ham radio manhours were dedicated to fire communications coverage.

Once again, amateur radio came through "when all else failed." We hope that the California government agencies and officials doubting the continued relevance of amateur radio communication (see last month's column) keep this in mind. Happy New Year!

If You Live in California…

Utilities in California are pre-emptively shutting off power to some customers to mitigate wildfire risk in particularly hazardous conditions (especially since power lines themselves have been implicated as the cause of several large fires). Pacific Gas & Electric offers these tips to its customers to be as prepared as possible:

How do you know if and when PG&E is shutting off your power? Update your contact information to ensure you receive timely alerts. The utility will notify customers at 48 hours, 24 hours, and just prior to shutting off power. Alerts will be sent through automated calls, texts, and emails. To update your contact information with PG&E, you can call (866) 743-6589. Even if you think PG&E has your information, be proactive and make sure it has your specific address on file and not only your Zip code.

If you are in a fire-prone area and not in a PG&E service area, contact your provider and confirm your contact information.

LEARNING CURVE

BY RON OCHU, KOØZ

75 Years and More to Come!

Photo A. Nazi Germany's V2 rocket helped scientists to usher in the space age. (Courtesy of Wikimedia Commons)

This month marks *CQ*'s 75th anniversary issue! Seventy-five years ago, World War II was ending, the Atomic Age was being ushered in, V2 rocket technology (*Photo A*) initiated a space race between the Soviet Union and the USA that culminated 24 years later when the USA successfully landed men on the moon (*Photo B*).

USA amateur radio operation was suspended by Congress during WWII and after the war, hams were slowly allowed to resume communications on the ham bands. Tubes were found in every radio, but American physicists Bardeen, Brattain, and Shockley, working at Bell Labs, were busy inventing the transistor. Three years later, its "unveiling" initiated an electronic technology revolution. The surplus market was flooded with WWII radios, like the ARC-5 (*Photo C*), and hams made good use of them. Frequency selection back then was controlled by crystals (*Photo D*), but not for long. CW (continuous wave) and AM (amplitude modulation) were the primary operating modes of the day. After the war, hams traveled by car and by train. Commercial aviation was primarily prop-propelled, but jet engines (another WWII invention) would eventually replace them. A lot of technology has changed since then.

Anniversaries mark achieved milestones that accompany change. Benjamin Franklin penned, "Change is the only constant in life." Kudos to everyone at CQ Communications Inc. for adapting to change, allowing it and the readers to celebrate its 75th anniversary. To be sure, anniversaries need to be celebrated, but they also serve to remind of us of where we've been. The American philosopher George Santayana wrote: "To know your future you must know your past." I don't think knowing our past will give us a clairvoyant, 20/20 view of the future. However, I do think, knowing our past aids us in avoiding past pitfalls and improving our future successes.

A Few Changes of Note

Some noteworthy changes affecting amateur radio appear in my introducto-

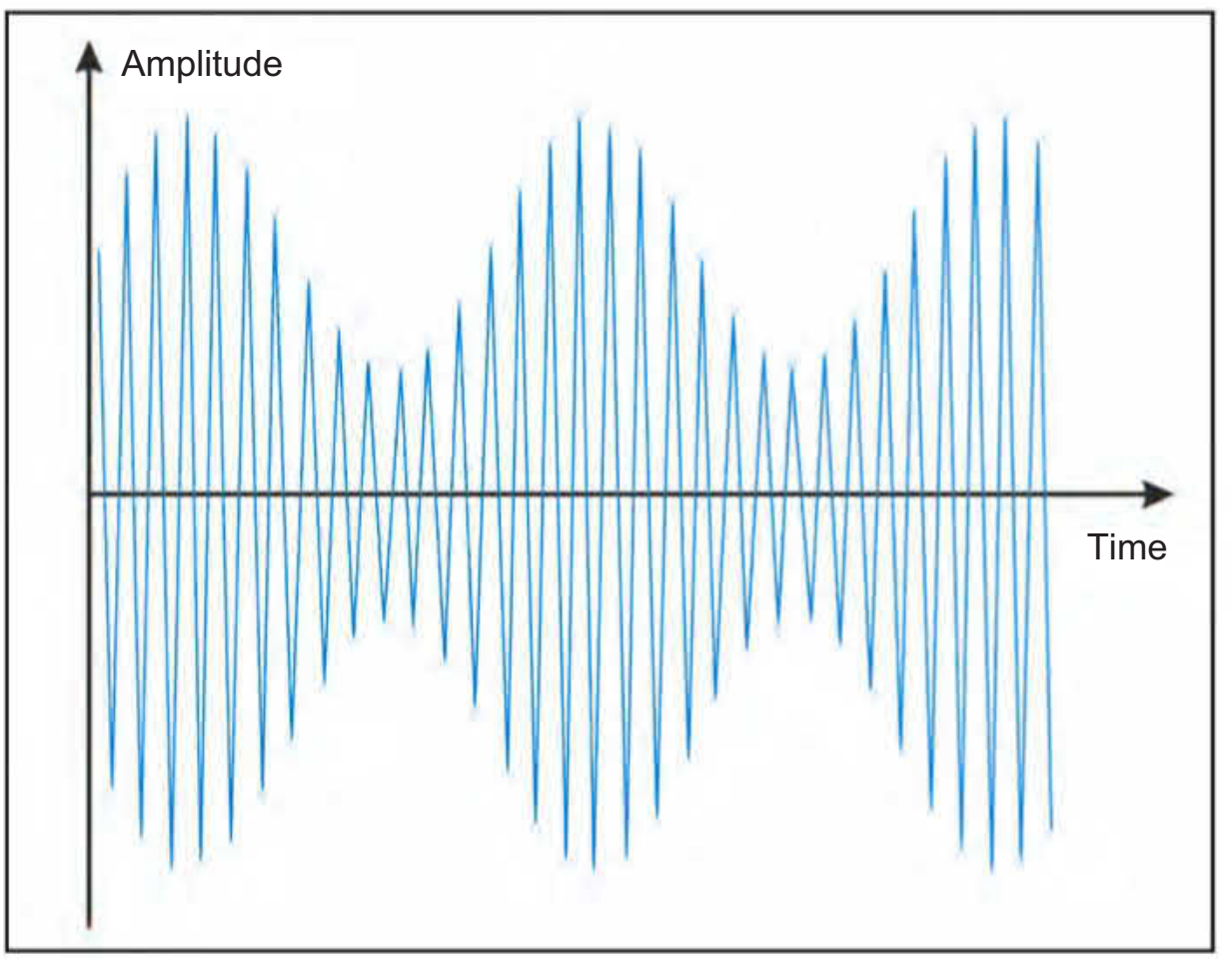

Figure 1. An example of an AM signal which is typically 6 kilohertz (6 kilocycles, 75 years ago) wide. (Courtesy of Wikimedia Commons)

*Email: <ko0z@cq-amateur-radio.com>

Photo B. NASA's Saturn V multi-stage rocket propelled Apollo 11's successful moon landing. (Courtesy of Wikimedia Commons)

Photo C. WWII era ARC-5 military radio eventually found its way into ham shacks via electronics surplus. (Courtesy of Wikimedia Commons)

Photo D. Seventy-five years ago, crystals were the primary means of generating an RF signal. (Photo by KOØZ)

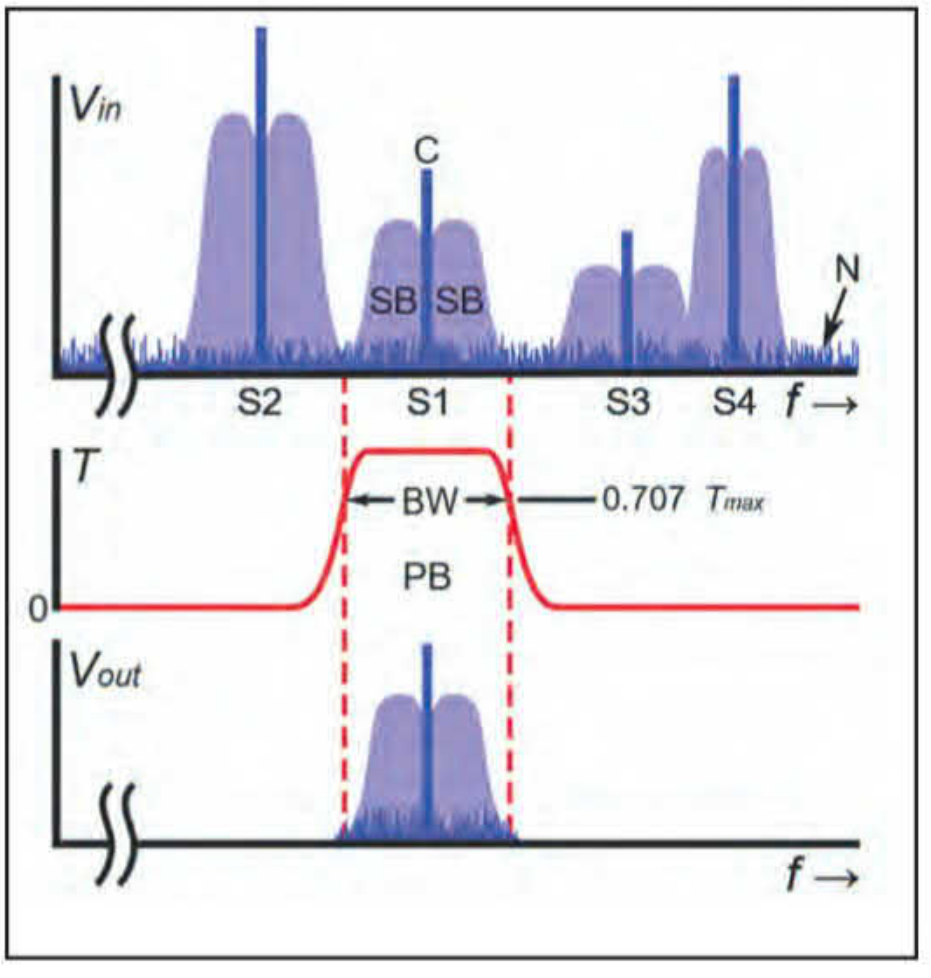

Figure 2. Note in this illustration that the carrier, "C," is surrounded by two identical sidebands on either side of it. In a SSB signal, the carrier is attenuated and one of the sidebands, upper or lower, is suppressed which results in more power being delivered to the desired 3-kHz-wide signal. (Courtesy of Wikimedia Commons)

ry paragraph. Even more significant changes were made in the ensuing years following WWII. Do you remember the FCC's (Federal Communications Commission) incentive licensing? Ham radio's introductory license used to be the Novice license. Next came the Technician class, General class, Advanced class and finally the Extra class license. There was also the Conditional class that was like the General class license.

Today, there are only three license classes: Technician, General, and Extra. Initially, all these licenses required successfully passing a Morse code exam (FCC Elements 1A, 1B, and 1C) by demonstrating at least one minute of correct, continuous, written copy. Later, a 10-question test could be used in place of the solid, one-minute copy. Element 1A consisted of listening to five minutes of a 5 wpm (word per minute) Morse code tape. Element 1B was a 13 wpm code test. Element 1C tested 20 wpm proficiency. In 1991, the FCC dropped the Morse code requirement for Technician-level licenses. At the time, noise was made proclaiming the death of CW (continuous wave), Morse code, and amateur radio. Such was not to be the case.

CW continues to be a very popular mode, and ham radio is alive and well. Earlier, similar concerns were expressed when the more efficient phone mode SSB (single side band) appeared and began to edge out AM. Although SSB and FM (frequency modulation) are today the "de facto" voice modes, AM enthusiasts abound and co-exist quite nicely.

History teaches us that newer, more efficient, modes can and do co-exist with older, traditional modes such as CW and AM. The point is that change can take an existing technology and improve upon it. For example, an AM signal (*Figure 1*) can occupy up to 6 kHz of bandwidth, whereas an SSB signal (*Figure 2*) will take up half that space. In other words, two conversations can now take place where there was only one. Granted, the audio fidelity of the SSB signal is not as good as that of the AM signal, but it is still understandable, and it is a more efficient use of band space in a limited amount of spectrum. Also, an SSB signal delivers more punch per watt as compared to an AM signal and that translates to more DX contacts. SSB is, by far, the prevalent voice mode on HF, but AM still can be heard. The end of the ham radio world as we know it did not end with SSB. Rather, SSB technology spurred further ham radio growth and challenges.

Ham Radio Milestones

Exploring all the changes to ham radio over the past 75 years would take a book. Instead, let's look at what your author has selected as ham radio milestones that influenced the hobby's growth. I am looking at technology and events that were pivotal in changing ham radio throughout the past 75 years and continue doing so today.

Surplus Market: WWII saw tremendous technological growth and innovation in industry. During the war, ham radio operators serving in the military gained a lot of on-the-air experience and new skills working with new technology. After the war, a surplus market was created, and military radios and CW straight keys (*Photo E*) became available for amateur radio use. Military radio test gear flooded the surplus market and hams could now afford high-tech test benches. DIY (do it yourself) experimenting and tinkering with surplus gear became the ham radio norm. Even now, we are blessed with industrial surplus gear. The automotive industry designed and implemented thousands of collision-warning microwave radar systems on its vehicles that created a market to supply low-cost microwave components. Ingenious hams are converting those devices to amateur use in the higher frequency microwave spectrum. Commercial cell phone and microwave communications gear entering into the surplus market allows hams affordable experimentation (*Photo F*). After WWII, military surplus spurred amateur radio experimentation. Today, commercial, high-speed wireless communication is driving the surplus market.

Commercial Gear: After WWII, most amateur radio equipment was either made from junk box parts, or "cannibalizing" old radios and televisions in the '50s. Commercial radio manufacturers found a market for ham radio after WWII. Big industrial names such as Collins, Hammarlund, Hallicrafters, and E.F. Johnson dominated the market, but their radios were pricey for many radio amateurs. Heathkit and Allied Radio's Knight-Kit sold kits as a more affordable means for many hams in the '50s, '60s and '70s to build and acquire gear for their stations. In the '70s, Japanese manufacturers such as Kenwood, Yaesu, and ICOM offered quality, brand new ham radio equipment less expensively than American-made radios and they soon dominated the amateur radio market. Even Heathkit had a hard time competing with the less-expensive Japanese radios.

Photo E. WWII era Morse code straight keys used for sending CW. (Photo by KOØZ)

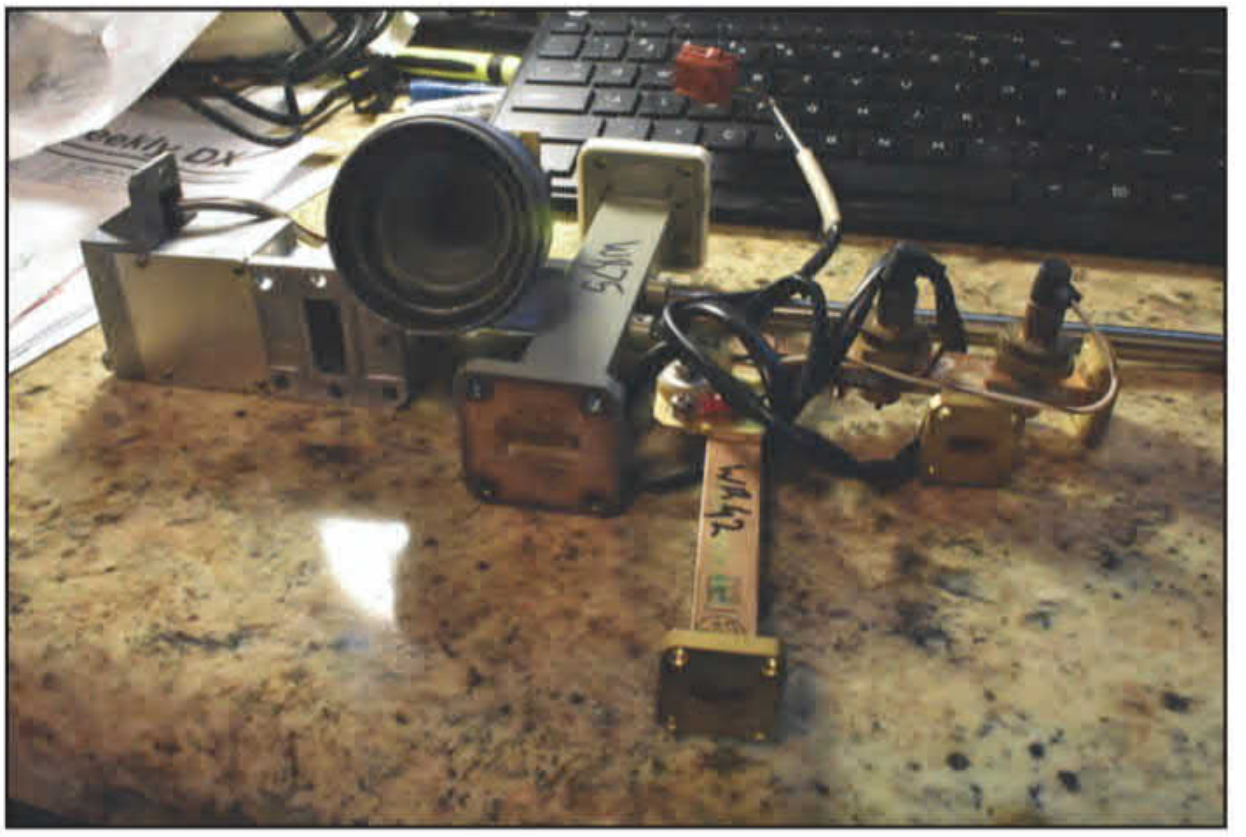

Photo F. Availability of microwave surplus allows for affordable "ham radio budget" experimentation in the "nosebleed" bands. (Photo by KOØZ)

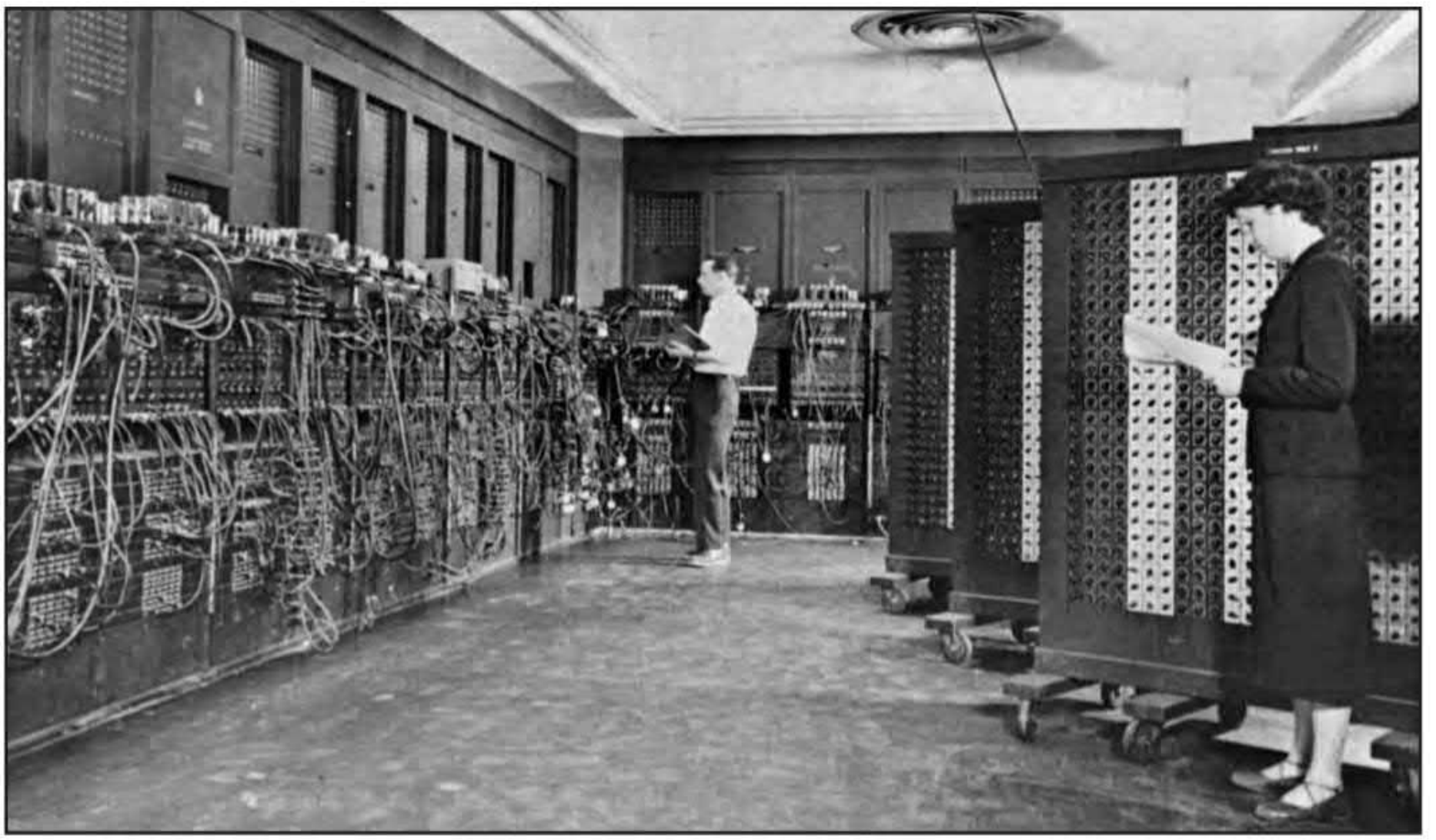

Photo G. The computer ENIAC, used tube (hollow-state) technology, consumed lots of power, generated tremendous heat, occupied large floor space, and was nowhere near as fast and powerful as today's PCs. (Courtesy of Wikimedia Commons)

Today, we see the same market phenomenon with Chinese radios and test gear in the ham radio market.

Another factor influencing commercial radio gear is demand. Major ham radio manufacturers seek out the needs of contesters as a barometer for future design improvements. Contesters, always looking for a competitive edge, make their ideas known to manufacturers. Manufacturers respond and contesters are eager to gain that edge and purchase radios accordingly. I don't see that dynamic changing and we all benefit. In addition to contesting, there's the "exotic" mode ham radio niche, such as digital amateur television, EME (Earth-Moon-Earth), satellite, QRP (low power), and VHF (very high frequency) and above experimentation. I predict that highly specialized companies that fulfill a special ham radio niche will continue to be in the offing, such as Down East Microwave, QRP manufacturers, M^2, and Directive Systems antennas to name a few.

Digital Modes: Spark gap and CW are, arguably, the first digital ham radio modes. Spark and CW consist of nothing more than an RF (radio frequency) signal being transmitted on or off for a determined period of time. Lately, digital technology is making tremendous inroads with modulation schemes far more complex than the original on or off associated with spark and CW. Yaesu's System Fusion, D-Star, DMR, and amateur digital television are popular digital modes. Likewise, Dr. Joe Taylor, K1JT, and Dr. Steve Franke, K9AN, combined forces to add FT8 and FT4 to Joe's WSJT software suite. These modes are consistently heard on ham radio bands, even when the bands are otherwise quiet. Drs. Taylor and Franke and their research teams have greatly contributed to the advancement of ham radio.

The digital ham radio revolution owes its existence to the popular personal computer (PC). PCs are prevalent in almost every ham shack and they have become an integral part of amateur radio operating. PC microprocessors are involved with everything from digital communications to electronic logging. Computers continue to shrink in size and increase in power. I think more of the same is in store for the next 75 years. As digital electronics and digital modes become more efficient, so will ham radio. In many figurative ways, radio technology shrank the world. News that used to take days to send now takes minutes. Satellites and the internet now deliver news in microseconds. We've only seen the beginning of this revolution.

Hollow-State / Solid-State Electronics

Personal computers came about largely due to solid-state electronics. At first, computers were powered by racks of vacuum tubes. By today's standards, these behemoth machines were power hogs, inefficient, and slow. One of the first, ENIAC (Electronic Numerical Integrator And Computer) built during WWII at the University of Pennsylvania, used tubes and occupied a huge space (*Photo G*). Vacuum tubes require high voltages and generate a lot of heat. ENIAC required thousands of vacuum tubes to operate. Computers weren't the only electronic devices that required tube technology. Amateur radio transmitters, receivers, transceivers, and amplifiers used tubes. A vacuum tube is hollow inside and it is a voltage amplifying device; hence, the reference to "hollow state" in today's parlance.

The element silicon revolutionized electronics by introducing silicon diodes and transistors. Soon transistors, a current amplifying device, began to replace tubes in consumer electronics (*Photo H*). Transistors evolved into smaller sized components and miniaturized electronics resulted. Continued research into shrinking transistor size and combining them

into a substrate material created entire circuits that came to be known as integrated circuits (ICs). Transistors, ICs and all their cousins are grouped together as "solid state." Today, commercially made ham radios are complex and heavily rely on solid-state electronics. What will the next 75 years hold? Promising research in organic electronics is being done. Organic electronics involve carbon-based polymers that are more efficient and "green" to operate. An OLED display found on many digital radio hotspots is an example of organic electronic development (*Photo I*).

OSCAR

In 1957, the Soviet Union shocked the world by launching Sputnik, the first human made satellite. Four years later OSCAR I (Orbiting Satellite Carrying Amateur Radio) made its debut (*Photo J*). Sputnik was a government-made satellite, but it took only four years for radio amateurs to build and deploy their own satellite, the first-ever non-government satellite. OSCAR 1 was a ham radio milestone. The spirit of ingenuity, engineering, and space exploration continues today with organizations such as AMSAT, the Radio Amateur Satellite Corporation, <www.amsat.org>. Satellite technology is vitally important to humankind's development. Satellites have increased our ability to communicate, to predict weather, to understand global ecology, to aid oceanography, to

Photo H. We can see the evolution of electronics from hollow- to solid-state electronic components. The promise of minimization that solid-state electronics provided is on full display from the bulky vacuum tubes to the tiny transistor. (Photo by KOØZ)

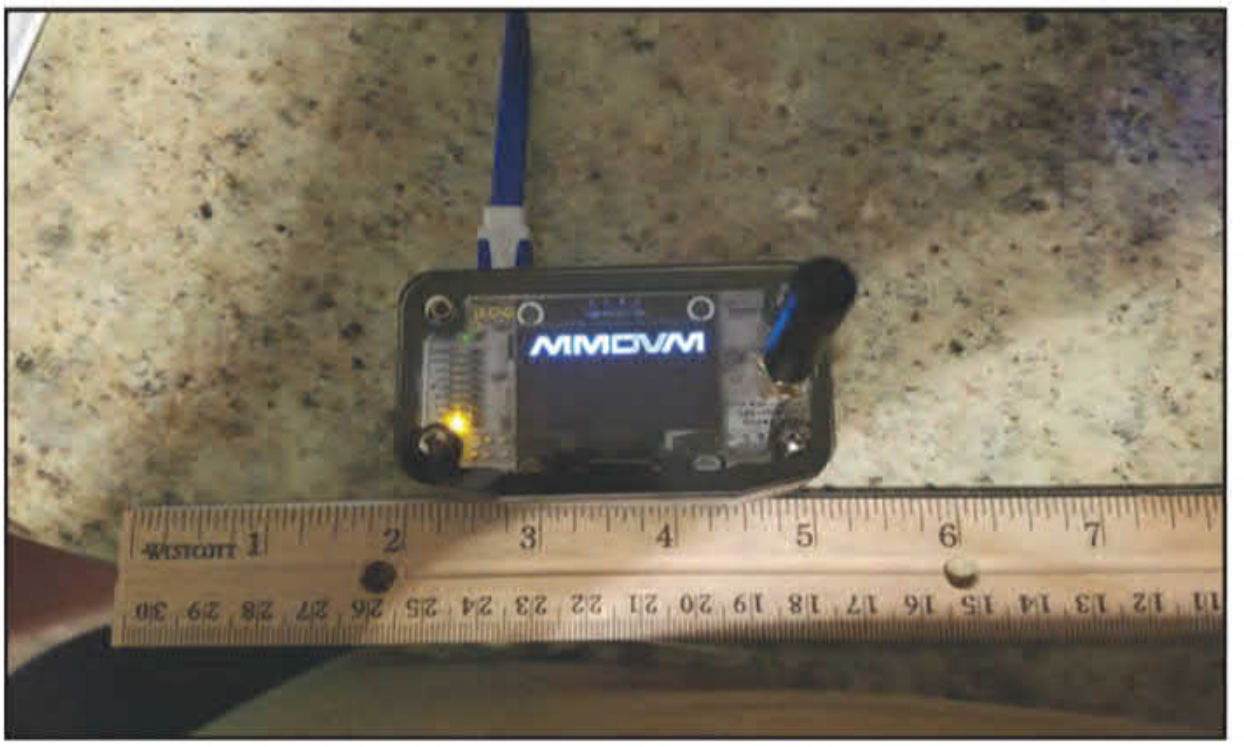

Photo I. OLED (organic light emitting diode) common on electronic displays is one example of the emerging field of organic electronics. (Photo by KOØZ)

study Earth's ionosphere, and to study our universe.

Amateur radio is used aboard the International Space Station (ISS) for educational and recreational purposes. It also serves as an emergency communication backup for the astronauts. As humankind sends expeditions to the moon and Earth's neighboring planets; no doubt, amateur radio will accompany them on their expeditions.

By no means have I touched on all the milestone accomplishments affecting amateur radio. However, this article does offer food for thought and perhaps some lively discussions over a cup of coffee at the next ham radio gathering over what did and what didn't make my list. I think we can all agree that what I have highlighted did serve as crucial ham radio pathways. Benjamin Franklin is correct; change is life's only constant. Humankind is experiencing change at breakneck speeds but taking note of our past and letting its lessons guide us, will ensure a more tranquil future. Thank you for reading *CQ* magazine and I wish everyone a very happy, joyful, and successful New Year!

– 73, Ron, KOØZ

Photo J. Only four years after Sputnik, ham radio operators launched OSCAR 1, the first of many OSCARS that now orbit Earth. (Courtesy of Wikimedia Commons)

ANALOG ADVENTURES

BY ERIC P. NICHOLS,* KL7AJ

Small Advances

In January 1945, American radio amateurs were still waiting for the end of the second war to end all wars. For better or worse since the beginning of human history, technology has always made its most rapid advances during times of war. Ghengis Khan's engineers invented the stirrup so his archers could turn around to shoot their arrows backward without falling off their horses. And long after the Mongol Empire became a footnote in world history, modern equestrian folks are grateful for the invention (even if they don't do much reverse horseback archery). When the blood and dust clear, one can usually find some new hardware to redeem for more pleasant purposes.

Radio amateurs were quick to beat their radio swords into plowshares once World War II ended, adapting a plethora of new techniques and hardware developed out of wartime duress. One of the advancements to which hams hadn't paid much attention in pre-war years was *miniaturization.*

In 1945, the transistor wasn't even a glint on the radar … that would come three years later. But military folks had made great strides in shrinking vacuum tubes, and their associated circuitry, down to … well … semi-portable configurations.

Needless to say, the SCR-536 (Photo A) wasn't quite as compact as your modern VHF handheld, but it pointed the way of things to come. Hams began to think *small.*

While a number of hams did indeed acquire surplus SCR-536s, (and a small and dedicated number of "green radio" collectors are amongst our ranks even today), post-war hams were just as likely to collect the *methods and techniques* as they were the actual hardware. Countless construction articles were bracketed with terms like *miniature, portable,* and *mobile.*

A number of miniature and sub-miniature tubes became readily available, and hams were quick to take advantage of these "hollow state" pre-transistors. The *acorn tube* was one such immensely popular device; not only was it *small*, but it was highly suitable for VHF operation, another rapidly expanding vista for post-war hams.

Smaller Wavelengths, Too

Not only were post-war hams paying attention to shrinking their radios, but they were becoming increasingly interested in shrinking their wavelengths, too. While there were a small number of VHF enthusiasts well before 1945, you really had to *want* to do VHF to do VHF. One didn't just "fall into" VHF operation. Everything involved with VHF was a challenge: Receiver sensitivity, transmitter stability, transmitter power … you name it.

The easy availability of surplus quartz crystals after the war made at least *one* aspect of VHF operation a lot simpler … building a transmitter that was likely to actually transmit somewhere within one's licensed VHF band.

A number of construction articles focused on converting 112-MHz equipment to the new 2-meter band. This fact alone proves that there wasn't a lot of off-the-shelf commercial amateur gear … especially for VHF frequencies. Incidentally, in the 1940s, 112 MHz (known then as megacycles) was considered "ultrahigh" frequency. But, needless to say, hams prevailed, and forged further ahead into the ultrahigh frontier. (*One of CQ's earliest columns, launched in 1946, was "UHF," written by Josephine Conklin, W9SLG. – ed.*)

PCBs

One rather unheralded development that began before the war was *printed circuit boards* (PCBs). While most hams of recent vintage consider PCB construction as something strictly associated with solid-state circuitry, this is not the case. PCB methods greatly increased ruggedness and reliability of a number of vacuum tube circuits, not to mention greatly reducing construction time over point-to-point wiring. If you happen to have a Heathkit SB-100 or similar vintage rig, you will find a great marriage of vacuum tube and PCB construction.

Photo A. The SCR-536 walkie-talkie was the ultimate in World War II radio miniaturization. (Public domain photo via Wikimedia Commons)

New Ways of Coaxing Signals Along

Another profound development of the post-war era was *coaxial cable.* Most present-day hams don't realize that until World War II, open wire feedline was the standard transmission line. Coaxial cable just didn't exist … at least in affordable quantities. Coax cable was primarily developed for shipboard operation; you could thread it through multiple bulkheads on a ship without interference. After the war, hams had access to untold thousands of miles of the stuff when it became available on the surplus market. Hams now had a

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brand new and convenient method of conveying RF from point A to point B … as well as something entirely new to obsess over … standing wave ratio. But that's another story for another article.

Thinking Smaller

Of course, there's a point of diminishing returns when it comes to miniaturizing radios. When handheld radios are so small you need to use a stylus to poke the buttons, you've probably reached that point. Personally, I think the point of diminishing returns for radio shrinkage occurred somewhere around 1980. However, when it comes to *wavelength* shrinkage, we have a long way to go. We have *12* microwave bands, most of which did not exist in 1945, and most of which remain nearly totally unoccupied today. We need to do more to develop this *true* "ultrahigh" frontier. Like every other amateur radio resource, we need to take a stance of "use it or lose it." Although these higher frequencies are generally lumped together in the "microwave" category, we should be aware that each and every amateur radio microwave band has unique properties that should be explored and capitalized on.

The January 1945 edition of *CQ* featured this article on page 11: *What You Can Do With Microwaves, by M.G. Bell.* "Microwave radio for hams has real [sic] possibilities, and there should be lots doing [sic] on these bands — when we get them." (*This article was republished in full in the September 2019 issue of* CQ*. – ed.*)

Keeping Well Grounded

While we need to further develop our ultrahighs, we need to take a look downwards as well. We have two brand-new, very hard fought "subterranean" bands: 630 and 2200 meters. I look at these new bands as a most-welcome "do-over." At one time, nearly all amateur radio was conducted down on the low frequencies. Just as we were figuring out how to most effectively use these wavelengths, we were essentially evicted from this territory to "200 meters and down," where supposedly we wouldn't be able to get out of our backyards. Now, with modern digital technologies that didn't exist 75 … or even five … years ago, we can and *will* communicate effectively on these frequencies … the *original* amateur frequencies. As HF propagation becomes ever more "flaky," relearning how to use our ground waves will be more important than ever.

Extrapolating

It has been said that you can't know where you're going if you don't know where you've been. Even if you *do* know where you've been, you can't always know where you're going. I don't believe we can draw a straight line from 1945 to 2020 and extrapolate that to figure out where we'll be in 2095. It will more likely be some exponential curve … presumably *upward.* We can make a few predictions along that curve, however. Almost certainly, we will be working with ever-increasing *bandwidth* communications … a great reason to explore our microwave frequencies. We will also be working with increasingly weaker signals. Marsbounce will likely be as commonplace as Moonbounce … within *legal* power limitations. Our radios will be increasingly more capable … even if they don't become any smaller physically.

And, almost certainly, we'll have a whole new generation of hams who will figure out how to do things we never even thought of. And, they might even figure out how to do them without another war to spur things on.

KIT-BUILDING

BY JOE EISENBERG,* KØNEB

The G-QRP Urmston Receiver: A Kit With a Long Heritage

Kits have always been a big part of amateur radio, making the hobby more affordable since the earliest days of radio. With *CQ* magazine celebrating its 75th anniversary this year, I thought it appropriate to review a kit that borrows on the technology of 75-plus years ago but brings a modern spin to it. Regenerative circuits were the mainstay of the earliest receivers we used as hams and they are still popular to this day due to their simplicity and effectiveness. The regenerative receiver shows up often in the kit world because of that simplicity as well as low cost. This month, we look at the G-QRP Club's 40-meter "Urmston" receiver.

Designed by the Rev. George Dobbs, G3RJV (SK), and Paul Darlington MØXPD, the Urmston receiver kit was designed to be built at the G-QRP Club Build-a-thon and is a great kit for beginning builders as well as for group building. The parts come bagged by stages, and this kit is built stage-by-stage. This method allows the builder to test each stage to be sure all is good before proceeding to the next one. Each stage has the test procedure at the end of the parts installation instructions for that stage. I highly recommend printing the manual in color as it makes the wiring, as well as parts identification, go much more easily.

In addition, there is a second set of instructions having a page of regenerative receiver operating tips as well as a grid map of the PC board, which is necessary for correct parts placement. Next to each part value in the manual is a grid locator, such as "B3". Looking on this locator map in the second set of directions shows you where that part is supposed to go. This is very helpful, since the parts' numbers and values are absent from the silkscreen printing on the PC board.

The front panel is assembled first, followed by the power supply. The audio amplifier comes next, after testing the power supply. Testing the power supply is simple using a digital voltmeter, and the test for the audio stage involves simply plugging in a speaker or headphones and listening for the background noise level to change with the volume control.

I found the instructions to be good, and following them — in order — makes for a successful building experience. The measurements for the connecting cables are in centimeters, so ensure your ruler has those measurements available. Be careful to not cut the control leads too short. Early in the build-

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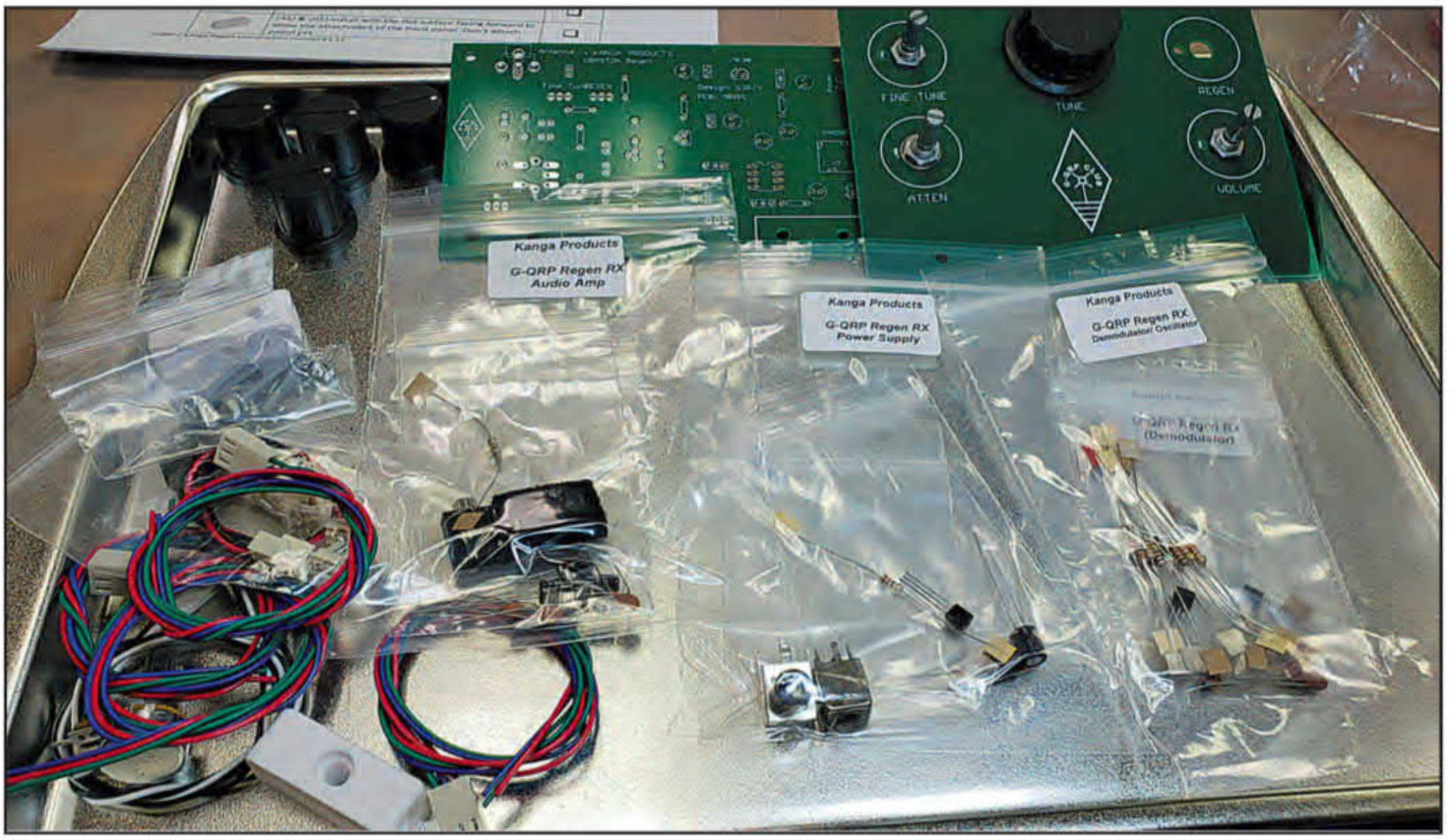
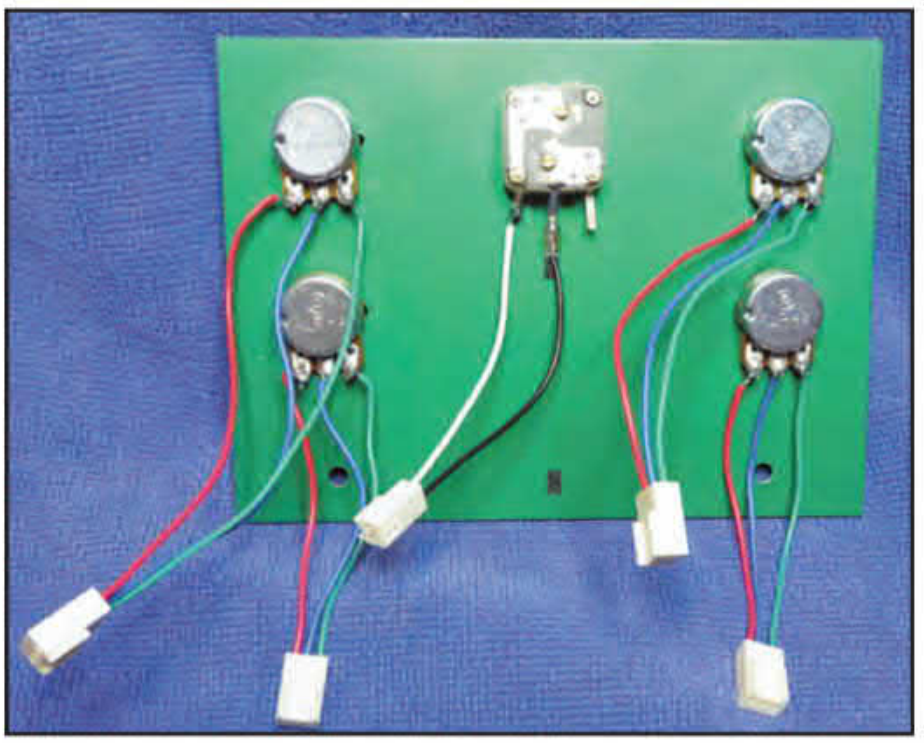
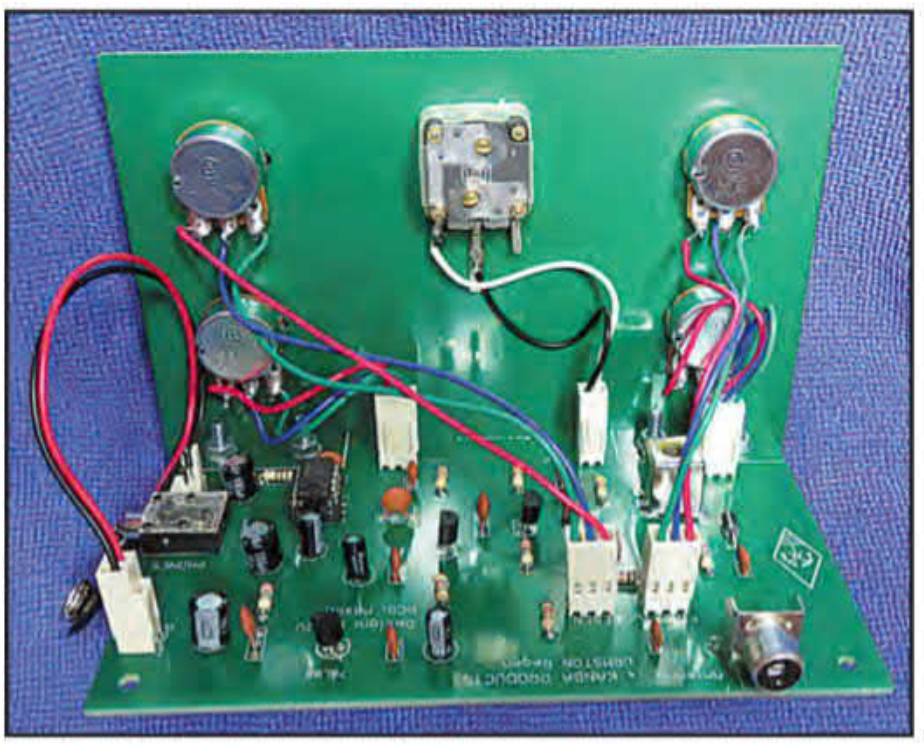


The G-QRP Club's Urmston receiver kit parts are bagged by stages, so the builder can progress stage-by-stage, making sure each stage is working before moving to the next step.



The back of the front panel showing the cable connections to each control. The connectors that plug into the board are pre-wired.

The completed front panel ready to be mounted to the main board.



The two boards assembled together and ready to tune in the 40-meter band.

ing process, you will be mounting the controls to the front panel and wiring the connecting cables to the controls. The two boards that make up the front panel and the main board are assembled together using the supplied plastic pieces. These plastic parts come pre-drilled and are ready to go.

Like many regenerative receivers, the main tuning goes rather fast, necessitating the use of a fine tuning control. Also, there is some drift when the receiver is first turned on as well. Using a regenerative receiver is kind of a knob twister's delight, as it takes a combination of the five controls to tune in the signal you want to hear. The first signal I was able to hear was in the FT8 part of the 40-meter band, distinguished by its 15-second transmission cycles. Tuning above the digital signals brought in the SSB portion of the band, followed by the high-power shortwave AM broadcast signals that are just above the 40-meter band. Tuning below the digital signals revealed some CW signals. As you turn the tuning control, you may have to adjust the amount of regeneration to keep the detector working. This is normal in many regenerative designs. The balance of adjusting the tuning, regeneration, attenuation, fine tuning, and volume make a regenerative receiver interesting to use. Move each control knob in small increments to ensure you don't pass the desired signals or detection threshold.

Regenerative receivers are subject to overload by strong signals, so don't be afraid to use a little attenuation if that becomes a problem. When tuning into shortwave AM signals, you need to reduce the amount of regeneration; and for CW or SSB, it goes higher. The amount of regeneration needed also varies depending on where the main tuning is set. The audio quality of the received shortwave broadcasts was very good. The audio in my headphones had a great volume with minimal settings so I never had to turn up the audio all the way.

I found the G-QRP Urmston receiver kit to be a fitting tribute to its designer and a great kit for use as a group kit build, or an afternoon or evening project. You can find this receiver kit from 3rd Planet Solar at <www.kc9on.com> for $39. Third Planet Solar also carries other G-QRP kits as well as its own lineup of inexpensive and simple kits.

QRP Guys' 3-Band DSB Transceiver

Since the first signal I heard with the Urmston kit was the distinctive sounds of FT8, I thought it would be appropriate to look at a kit designed to operate this popular mode. The QRP Guys 3-band DSB Transceiver will be my first look at a kit designed to get you on FT8. With three pluggable fixed-frequency band modules, this unique kit brings the digital world to your computer at a low cost. Look for this innovative kit in an upcoming issue!

Review Your ESD Procedures

With the cold weather season at hand, it is a good time to review electrostatic discharge (ESD) procedures and ensure you have a way of avoiding static discharge damage to your kits. When your home heating system raises the outside air temperature from the single digits to 70°F, the humidity level goes way down, making static electricity a problem for kit builders. A humidifier can offer a solution along with using anti-static mats and wrist straps.

Because February is a great time of the year to get out of Nebraska, I will be again presenting at the Orlando Hamcation, so be sure to say "hi" when you see me in Orlando!

Until next time, 73 de KØNEB

MAGIC IN THE SKY

BY JEFF REINHARDT,* AA6JR

Milestones

As we reflect on the 75th anniversary of *CQ,* it seems appropriate to recall the significant milestones that stand out in each of *our* lives. You see, by reading these pages, *CQ's* anniversary isn't about us — it's about you, because without you, all the content found in this issue, and all the issues that precede it, is meaningless. So thank you for making *CQ* part of your life. While I'm just one contributor among a more talented list of other writers, it's an honor to be counted among them and to be part of the crew that arrives in your mailbox or email each month as we celebrate this amazing thing called radio, in its seemingly ever-expanding forms.

Each of us can reflect on significant personal milestones, be it the transitions of our private lives, from tot to teen to young adult, middle age, and so on. Or the milestones marking the paths we take through education, career choices, and how we may spend our leisure time. What's mind boggling, at least to me, are the unknown generations of those who made it possible for me to have a place on this planet. We're all carrying around the DNA signatures of unknown ancestors dating back through millennia, and somehow through any number of factors, be it luck, fate, lessons learned, intelligence, genetics, natural selection, or many other unknowns, — poof — here we are, occupying the planet at this time and in this place. Is this a great time to be alive or what?

The Procession

I'll leave it to astrophysicists, philosophers, religious leaders, and other theoreticians to continue the discussions of how we got here. But let's narrow down our focus to the evolution of the communication arts for a few moments.

Maybe you're familiar with *The Moody Blues,* whose musical works have endured the test of time from the mid 1960s to the present. If not, may I recommend listening to the first cut of their album *Every Good Boy Deserves Favour.* If you have that album, be it vinyl or CD, the cover art is also a reflection of the wonder we all find in discovering our love for learning about things that fascinate our imaginations and stimulate our curiosity, from those who came before us. The musical selection I recommend is called *Procession* and it traces the evolution of music from the dawn of man to the present in just a few well-composed minutes. On first hearing this piece several decades back, it sent chills up my spine, as it recreated the dawn of communication from the dawn of man. One person beats a hollow log with a stick in a distinct pattern — scant moments later a distant reply is heard in its own pattern, and thus it begins. Think of that drumbeat as the first "CQ". And when the response came, the planet has not been silent since.

Evolution

Consider for a moment the span between the exchange of hollow log drumbeats to our current-day ability to instantly engage in world-wide communications and the vast infrastructure of terrestrial and orbiting platforms that routinely and perfectly perform what we take for granted. It's sad that only when those systems occasionally fail to function in their assigned tasks do many folks take notice of their existence.

But the wonder that was unleashed by those hollow logs turned loose man's desire and abilities at seeking to communicate over greater distances at ever-increasing speeds. I'll submit the first widespread long-distance communications systems were lighthouses. True, they were one-way transmissions but consider the number of lives that were spared and the commerce that flowed reliably and safely because of their presence.

The delivery of written communications no doubt evolved from individual messengers to horseback riders and even carrier pigeons into today's rather sophisticated mail delivery systems, which are now yielding to electronic delivery. As a side benefit of the need to communicate, the significance of message delivery can still be found in the many "post roads" located mainly in the northeast portions of the USA. Many transportation corridors were opened for the purpose of delivering the mail, which is one reason the U.S. government's original cabinet had a designation for Secretary of the Post Office. Today's communications thoroughfare is the internet.

In our evolutionary track, we'll also give some credit to Napoleon, who communicated over great distances for military purposes using line-of-sight semaphore towers for a time, but their usefulness at night and during adverse weather were pretty significant limitations.

The Second Drumbeat

While the original prehistoric drumbeat operators may have started the communications procession; Samuel F.B. Morse

The Moody Blues' album, Every Good Boy Deserves Favour, includes a song called Procession that speaks to the history of music as we look back on the history of communication. (Cover art photo by AA6JR)

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hit the proverbial "fast-forward" button with his own drumbeats, the first dot-dash clickings from a device that could instantly convey intelligence through wires strung over great distances. I'll invoke a much-overused phrase from the world of advertising, but even back then someone must have said, "Now this changes everything."

News and information that took months, weeks, or days to conquer distance shrank to mere moments. The information explosion that began with Gutenberg's printing press had literally now accelerated to light speed.

As telegraphic wires crisscrossed the continents and eventually the oceans, the notion of communicating *without* connecting wires challenged and tantalized the physicists and experimenters of the 19th century. Names like Maxwell, Volta, Ohm, Tesla, Marconi, DeForest, Armstrong, and many others are forever etched in the history books, though the true impacts of their discoveries continue to unfold before us. The mid 20th century saw the development of silicon technologies that may stand in equal or greater significance to all that came before it.

Phase Three, Anyone?

So as we contemplate that teasing question, "what's next?" let's just take a deep breath to consider where we are because of electronics and radio communications. Yes, computers, smart phones, tablets, HDTV, the internet, and many other miracles have become everyday realities in the 75 years during which *CQ* has visited the homes of radio enthusiasts.

Let's not forget that your ham radio license is also your ticket to a vast unseen but very real playground for the imagination. We can certainly celebrate our heritage by enjoying the dots and dashes of a CW connection. For me it's still a thrill to transmit a CQ call, not knowing who may respond; but it's sent in the hope of making a new acquaintance through the ether. And here's a salute to the hardcore experimenters who choose the challenges of QRP, moon bounce, low-frequency communications; "hilltoppers" pushing the limits of microwave connections, new digital modes or old ones like RTTY and the like. The chitchat of a 2-meter roundtable during the daily commute is still a pleasant way to enjoy our ability to communicate.

As you read this, hams across the USA and around the world are ready to use their skills and equipment to aid those in distress through their own vigilance or through organizations like RACES, ARES, Red Cross, Salvation Army, and Skywarn.

Reflect for a moment on the day your interest in radio communications took root. Something ignited your curiosity into wanting to learn more about this mysterious art. It drove you into learning about theory, practical applications of components, and the desire to reach out beyond your present location to communicate with others. In order to achieve those objectives, you also learned how to overcome obstacles, how to conquer difficulties, and how to feel the joy of success, perhaps none more thrilling than your first QSO.

Speaking of the stuff dreams are made of, we should not take for granted the many connections students across the country have had with the International Space Station using ham radio as the link. I want to believe that among those students, there may be a few young men or women who not only enjoy the connection with a real astronaut, but inside a few of those youngsters a calling is heard that harkens back through the millennia, perhaps encoded in our *homo sapiens* DNA, to that prehistoric hollow log. While the last 75 years have been about us, it's their talent that will lead to the new great inventions or discoveries; it is the calling to leave their signature on the next 75 years of mastering the *Magic In The Sky.*

Looking Ahead

Here are some of the articles we're working on for upcoming issues of ***CQ***:

QRP Special in February

- Operating QRP Portable and Fooling Your HOA
- QRP From There to Here (A Personal QRP History)
- QRP From Cannon Mountain

Plus…

- Results: 2019 CQ World Wide Foxhunting Weekend
- 2020 WPX Crossword Puzzle
- Does an Antenna's Orientation Affect a Signal's Sound?

Upcoming Special Issues

June: Take it to the Field
October: Emergency Communications
December: Technology

Do you have a hobby radio story to tell? Personal ham history for our 75th anniversary year? Something for one of our specials? *CQ* now covers the entire radio hobby. See our writers' guidelines on the CQ website at <http://bit.ly/2qBFOdU>.

THE HAM NOTEBOOK

TEXT AND PHOTOS BY WAYNE YOSHIDA*, KH6WZ

SMT, SMD and µP

An Alphabet Soup of Progress

Surface-mount technology (SMT), Surface-mount devices (SMD), and microprocessors (µP) are modern construction techniques that are taken for granted in all the electronic products we use every day. They are the products of a construction evolution that began with point-to-point wiring, which led to printed circuit boards (PCB) to SMT. *Photo A* is a picture of an old stereo amplifier with point-to-point wiring. No, this is not used for an amateur radio purpose, but it illustrates the point-to-point wiring technique.

These modern construction and manufacturing techniques and devices revolutionized the way our equipment is designed, built, and tested. Nearly 100% of electronic products today are made using these techniques and components. Even wire connections between boards and modules are being replaced with flexible, multi-conductor strips.

SMT and µPs enable miniaturization, enhance reliability, and simplify component procurement, placement and production. For RF products, SMT and SMD can reduce unwanted effects of stray inductance and capacitance, enabling high performance in the VHF spectrum and beyond.

Even amateur radio electronic kits have improved and evolved along with these techniques and components. A comparison of old and new can be seen in *Photos B* and *C*.

On the left is an old Heathkit SB-102 transceiver kit from the 1970s. (I know, it needs a good cleaning; it's in my restoration queue and, eventually, it will be taken apart and rebuilt … someday –*WY*). The SB-102 features 80- to 10-meter band operation (no WARC bands), vacuum tubes, and requires an external speaker and power supply. Operating modes are CW and SSB. Transmit power is 100 watts. There are dangerous high voltages inside. It measures about 15-inches wide x 6.75-inches high x 14-inches deep and weighs about 23 pounds. A separate, optional unit enables split operation.

Photo A. This stereo amplifier is shown as an example of point-to-point wiring. It's very labor-intensive, compared to anything made with printed circuit board wiring.

On the right is a modern kit example, the Elecraft K3s transceiver. It features 160- to 6-meter operation (including the WARC bands), 100 memory channels, digital signal processing (DSP), and many, many other features. Dual VFOs are built-in. Operating modes include USB, LSB, AM, FM, CW, FSK, AFSK, and PSK. A PSK, RTTY, and CW text decode / display capability is built-in. Transmit power is adjustable from 10 to 100 watts. It measures about 11-inches wide x 4-inches high x 11-inches deep and weighs about 8.5 pounds. It operates from an external 13.8-volt DC power supply.

A Boon for Constructors

The combination of SMT, SMDs and µPs makes possible experimentation into the ultra-high frequency (UHF) bands that was unimaginable only a few decades ago. Surplus modules and systems, manufacturer component reference designs and evaluation boards are available that enable practical rigs for the microwave bands at 2 GHz and — "way" beyond.

Photo D is an example of a manufacturer's sample kit and evaluation board, available through its distribution network. The Analog Devices "RF Detector Surf Board" features three detector RF ICs covering various frequency ranges, mounted on a circuit board, with inputs and outputs and other connections marked. This will be the basis of an RF power detector / meter for the VHF to microwave bands. The Analog Devices part number is ADL5XDETECTORKIT. It's another project in my "To Make" queue.

Photo E is an example of surplus material available to hams. The Qualcomm frequency synthesizer board (known as "The 1152 Board") is the heart of many microwave transverters. It can be modified to generate useful

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2020-2021 calendar

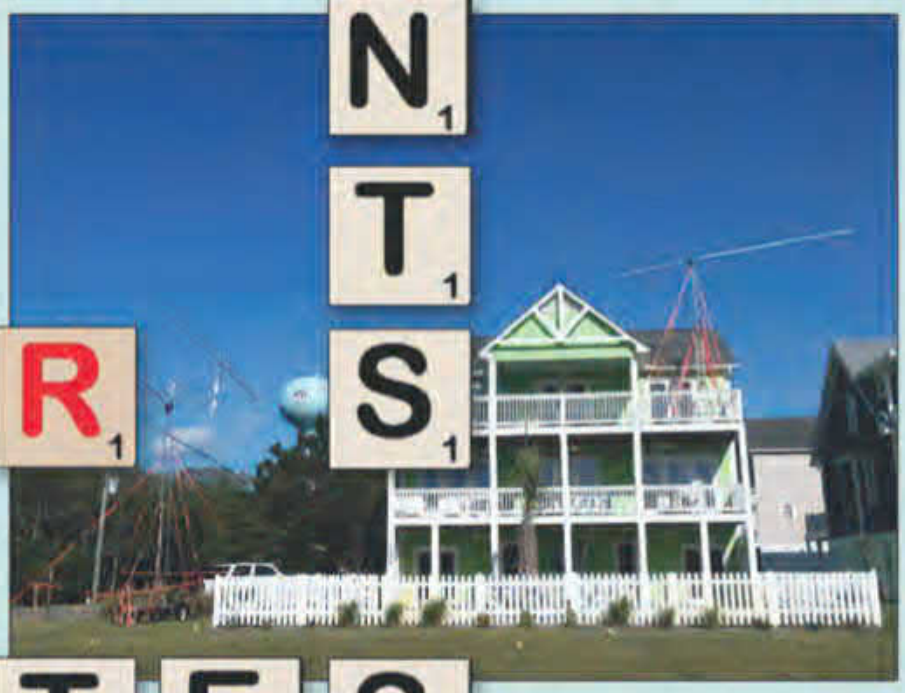
Each year our calendar offers fifteen spectacular color images relating to amateur radio: shacks and antennas from across the country, DXpeditions to exotic places, and fellow hams enjoying the hobby.

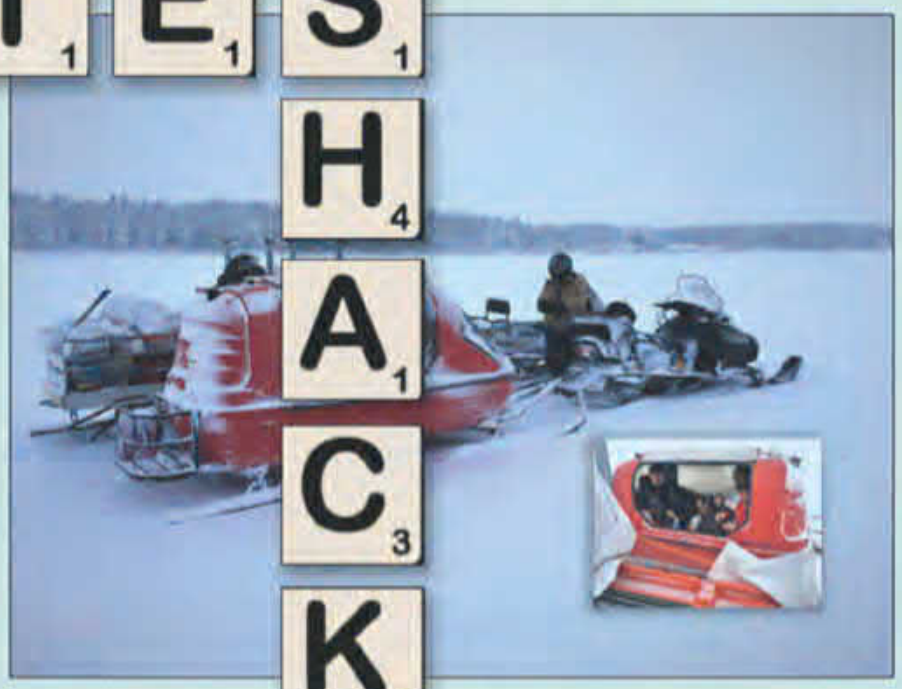
Calendars include dates of important Ham Radio events, major contests and other operating events, meteor showers, phases of the moon, and other astronomical information, plus important and popular holidays. CQ's 15-month calendar (January 2020 through March 2021) is a must have!

$12.95 plus shipping

15 months of value
January 2020
through March 2021

Order yours today!





Shipping charges:
USA $3; Canada/Mexico $5;
All other countries $10.

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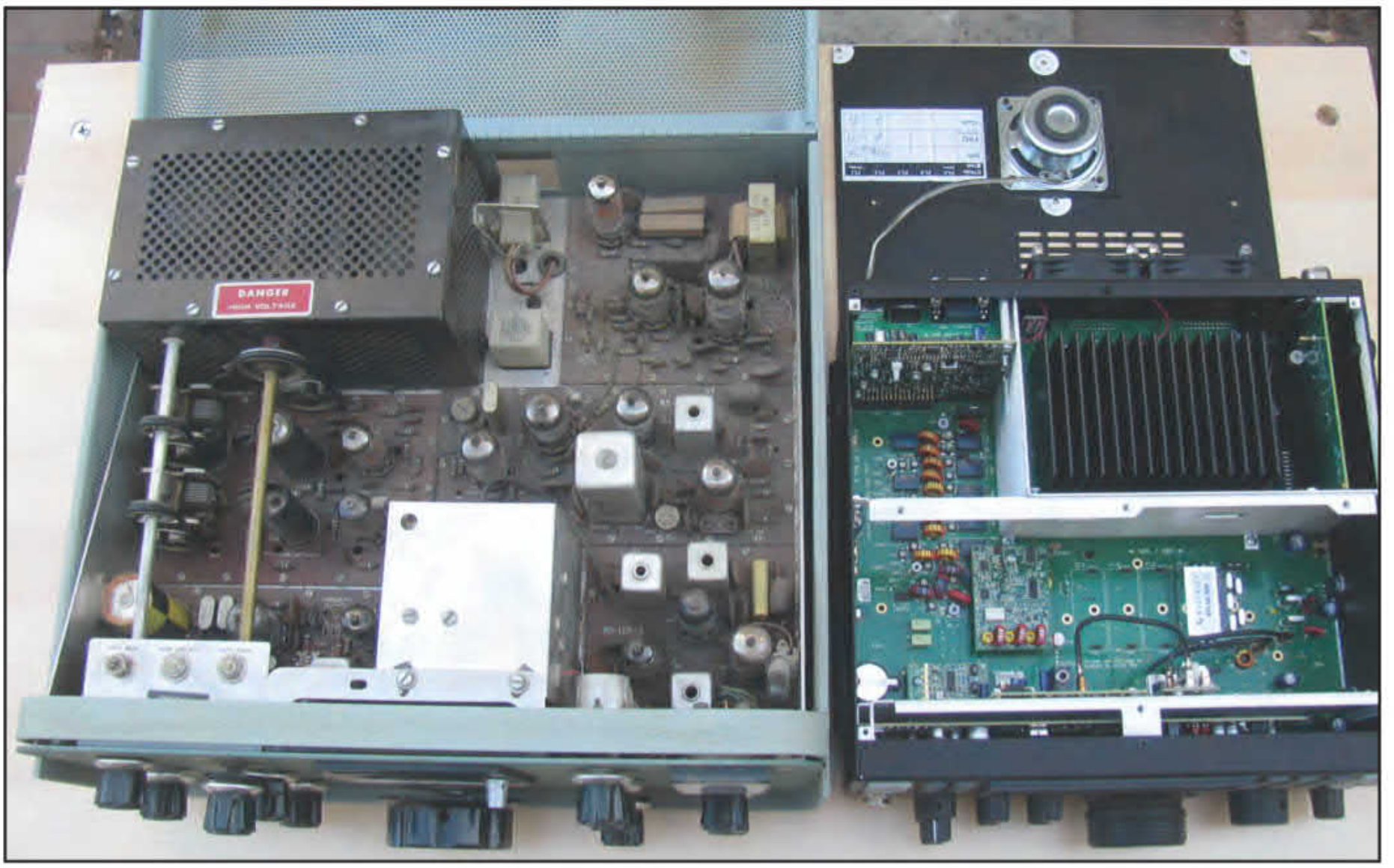

Photo B. A quick look inside these two HF transceiver kits shows the evolution from PCB construction with non-SMD components and vacuum tubes to SMT circuit boards and SMD components.

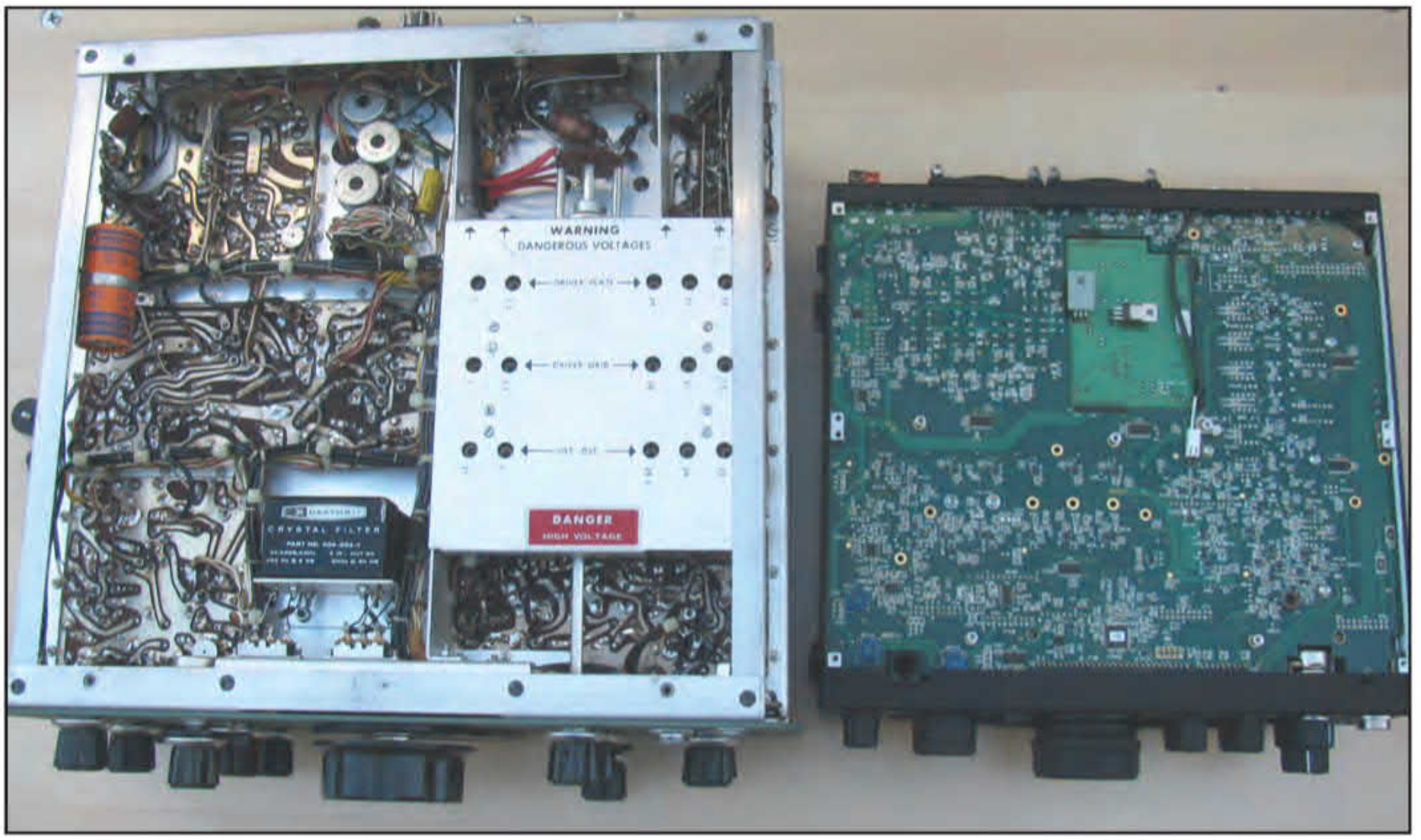

Photo C. Comparing the underside of both rigs is even more interesting.

local oscillator (LO) frequencies such as 1152 MHz. Harmonics from 1152 MHz result in good reference signals for several microwave ham bands — 2304, 3456, 5760, and 10368 MHz. More information on this useful surplus item can be found on the San Bernardino Microwave Society (SBMS) website, <www.ham-radio.com/sbms>.

Photo F is an inside view of one of my 10-GHz transverter system modules. It is a surplus unit and includes high-per-

Photo D. Device manufacturer's sample kits and evaluation boards provide an almost ready-made solution for various needs.

Photo E. Availability of surplus components and modules enable microwave experimentation and high performance at a reasonable cost.

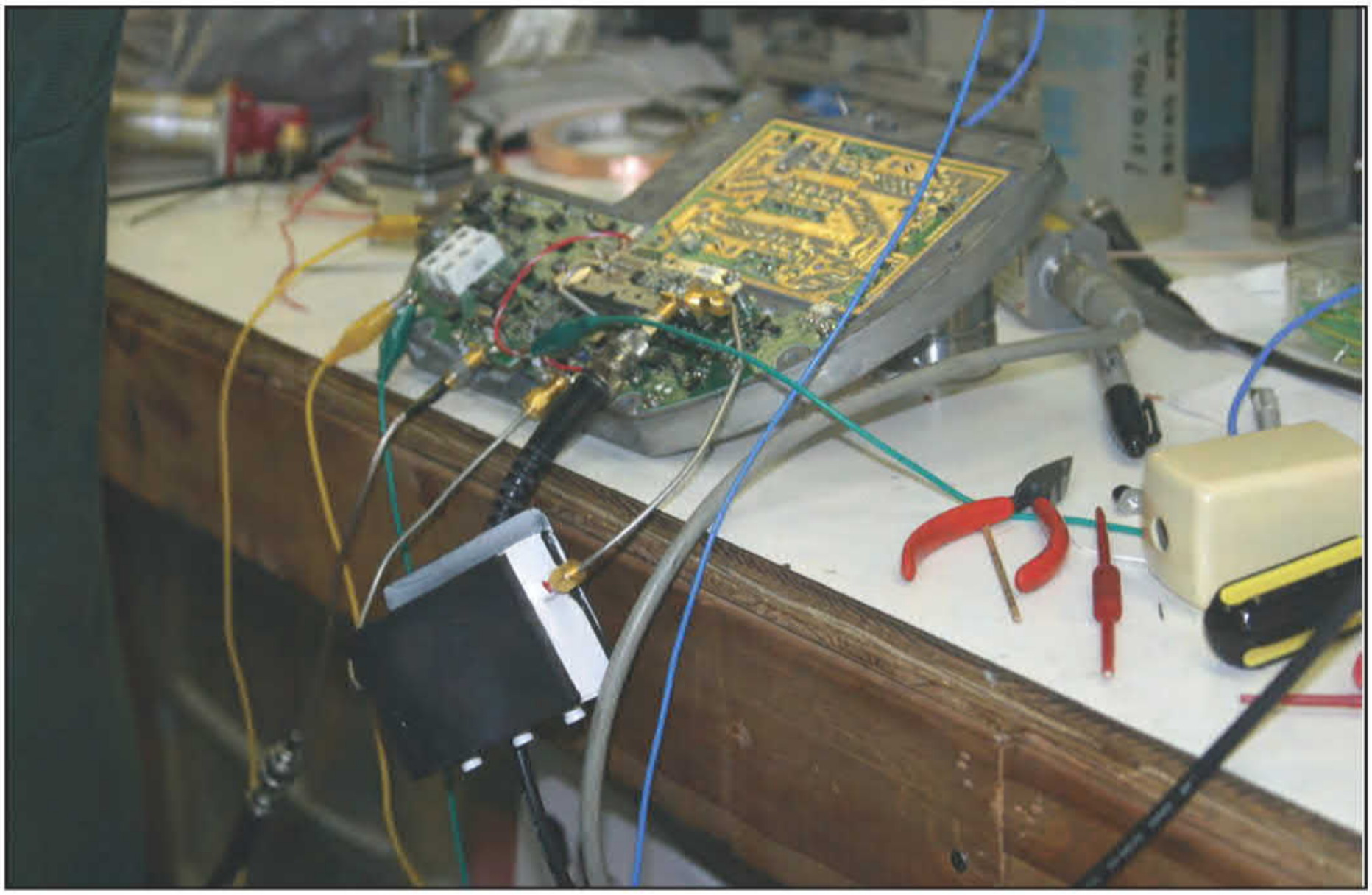

Photo F. One of my 10-GHz transverter systems under test. The main converter module is a surplus item with SMT boards and MMICs.

formance Monolithic Microwave Integrated Circuits (MMIC) and SMT board construction. Filters are re-tuned, some circuits are bypassed and various control circuits are added to enable narrowband, ham-band operation.

My maker-ham friend, Tony Long, KC6QHP, built a pair of 79-GHz transverters using surplus modules and home-designed and built circuits (*Photo G*).

In fact, there are already DX records being set on the 122- and 242-GHz ham bands. No, those are not typographical errors. These are the millimeter-wave bands. I am procuring the parts to make a pair of 122-GHz systems and hope to get on the air this contest season.

Computers on a Chip and Other Integration: µPs, ASICs, and MMICs

The microprocessor (µP), Application-Specific Integrated Circuit (ASIC), and MMICs are also prevalent in today's electronic products. From simple, everyday gadgets like garage door opener receivers and transmitters to clothing washers and dryers, µPs are everywhere. So it makes sense that our rigs should have this capability, too.

Photo H is an example of a modern 2-meter / 70-centimeter mobile transceiver, showing the microprocessor board. This is the brains and heart of the transceiver, controlling all operating and user-programming features such as 1,000 memory channels that each store frequency, offset, transmit power, subtone, and other parameters. Mobile and portable VHF and UHF gear has come

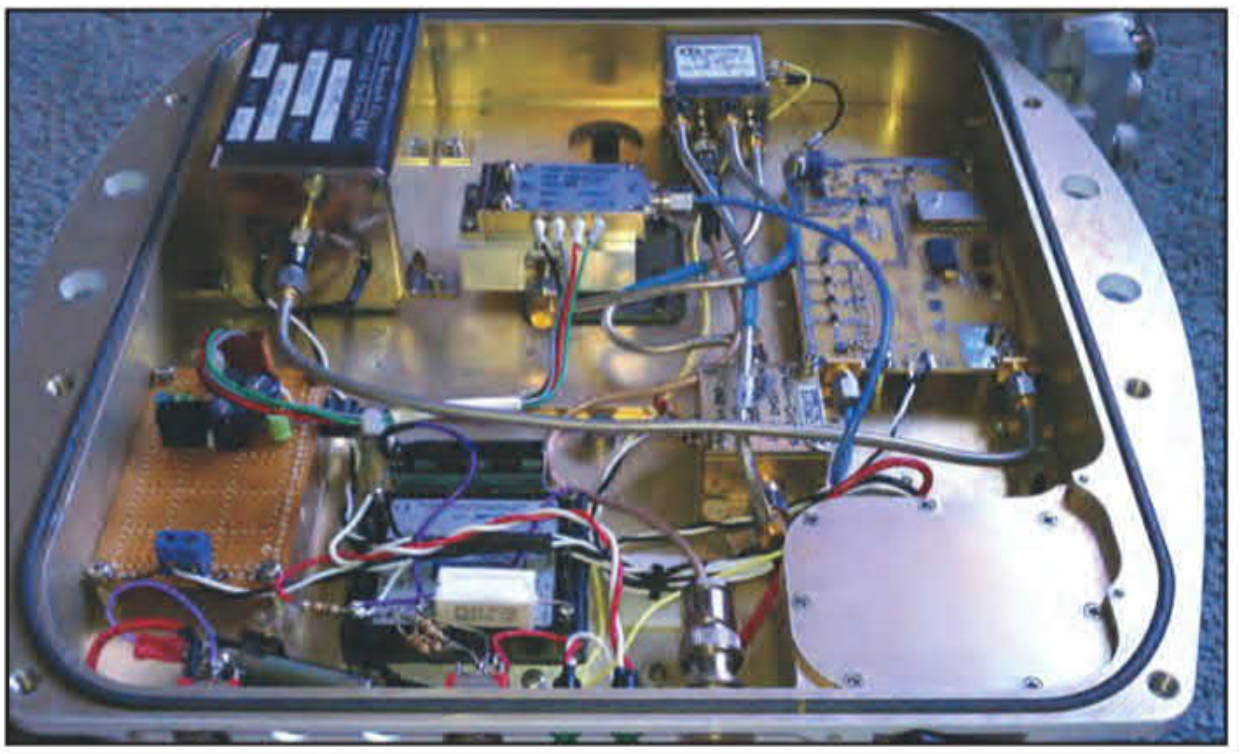

Photo G. An inside look at a 79-GHz transverter made with surplus and home-built circuits built by Tony Long, KC6QHP. (Photo by Tony Long, KC6QHP)

a long way from the early crystal-controlled units, which were pretty much limited to receive and transmit frequency control.

Several years ago, I demonstrated a simple "then and now" comparison to illustrate the idea of "microprocessor control power" (*Photo I*). It is a comparison between my Johnson Match Box, a classic antenna matching unit from the 1950s, and my Yaesu automatic antenna tuner from the 2000s.

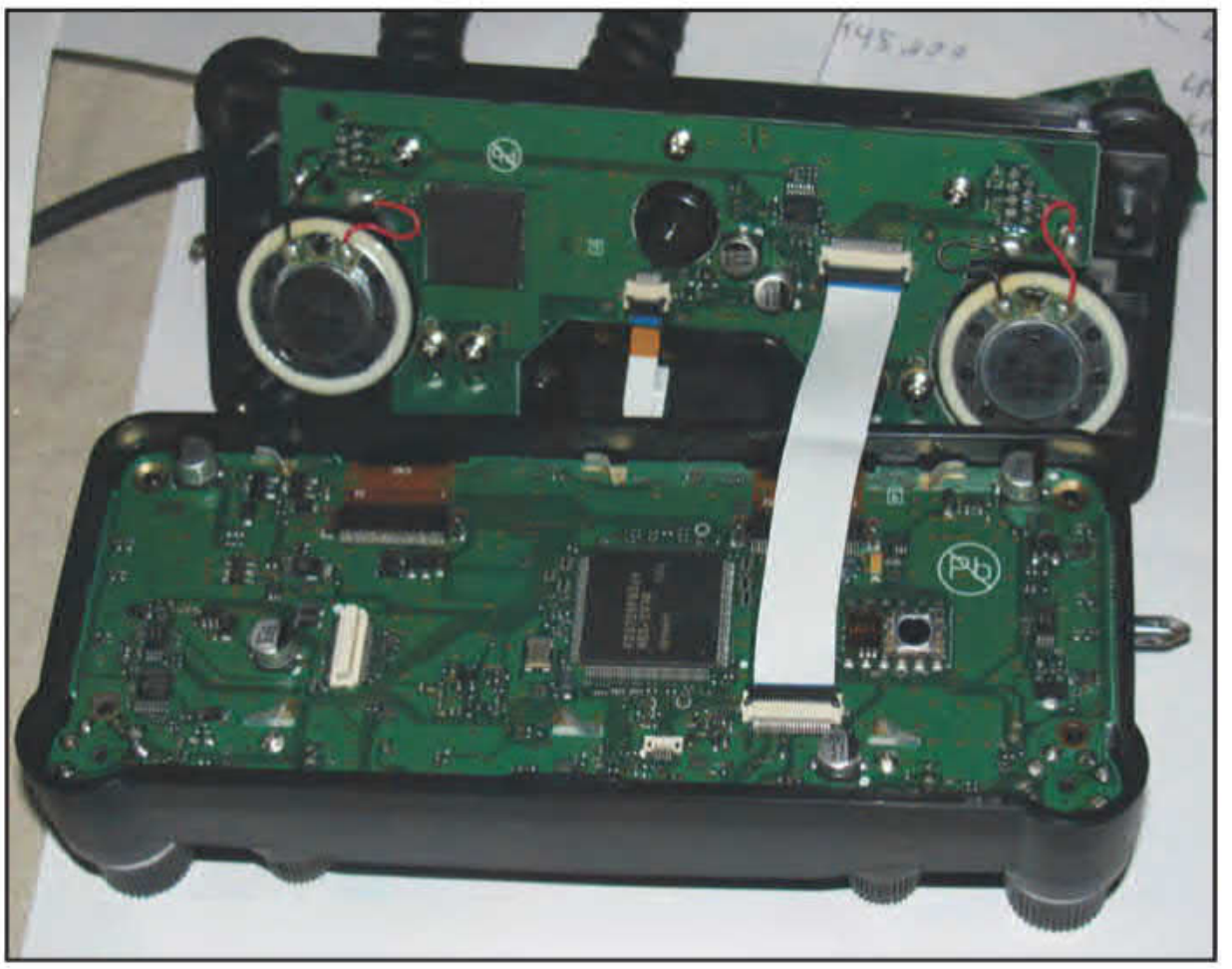

Photo H. A look at the microcontroller board inside a modern VHF/UHF mobile transceiver. The µP controls all operating features of the rig.

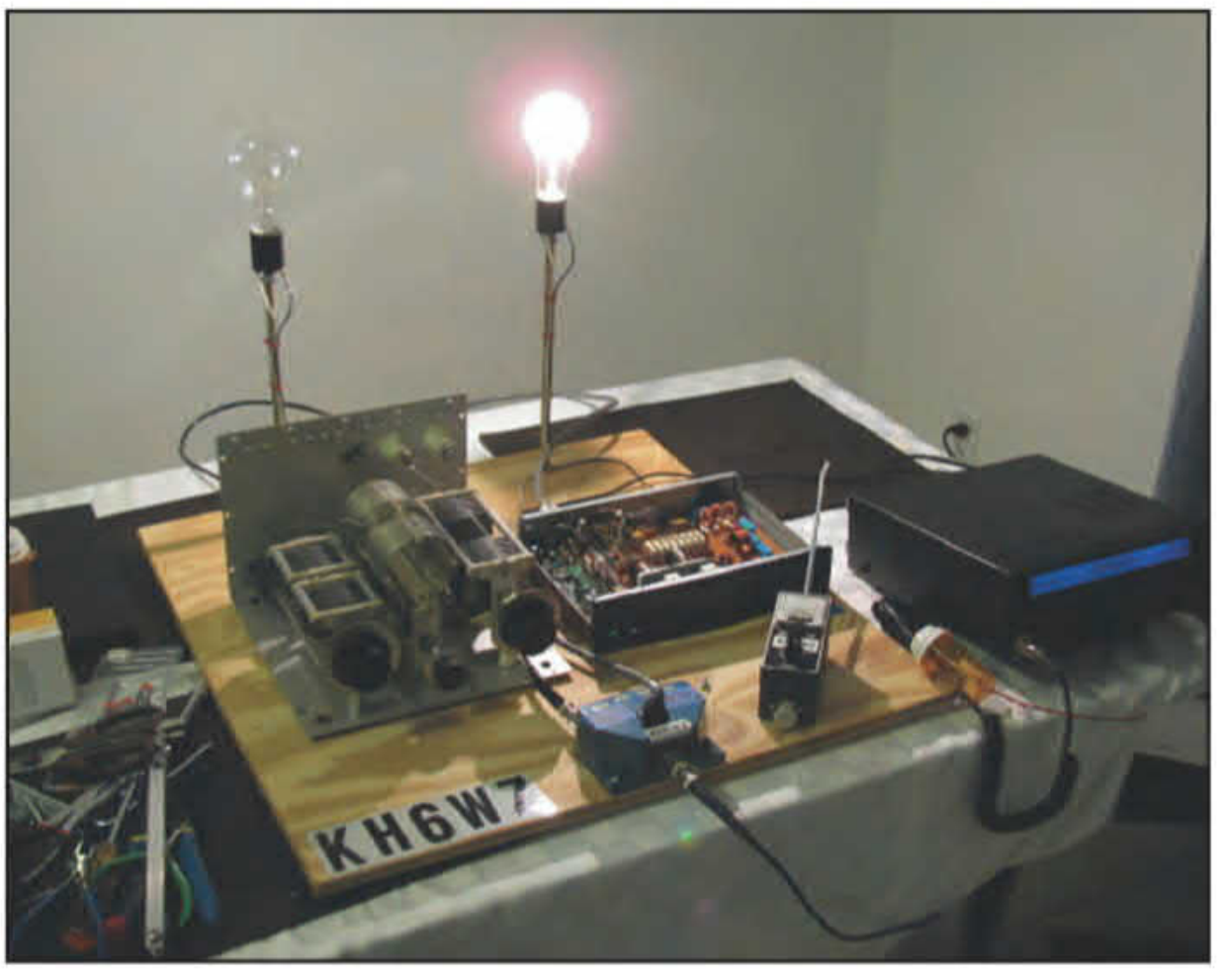

Photo I. I demonstrated old versus new technology at a Maker Faire. It is a very good, visual demonstration of what microprocessors can enable.

The two antenna tuners are placed side-by-side. A Yaesu FT-847 HF to UHF transceiver supplies RF at various frequencies into one tuner at a time via a coax switch. Light bulbs are used as mismatched antenna loads. A small SWR meter is included to watch for best match.

It is a very effective demonstration of what microprocessor control can do: The finicky Johnson Match Box may take dozens of seconds — or never — to find a suitable match. And the knobs and switches must be moved by hand. But the Yaesu tuner can find a match in less than a second — and in mostly all cases without touching it.

As mentioned earlier, integration and special ICs enable miniaturization. Another fantastic example of this is something called "Analog Discovery 2," shown in *Photos J* and *K*, which is made by a company called Digilent. The Analog Discovery 2 was featured on the "Ham Radio Workbench" podcast <https://tinyurl.com/u9znlb6>.

Designed for university students, it is a highly sophisticated test instrument in a box about 3-1/4 inches square. Used with a personal computer, this unit is nearly a dozen instruments in one, including:

1) Two-channel oscilloscope
2) Two-channel function generator
3) Stereo audio amplifier
4) Sixteen-channel pattern generator
5) Sixteen-channel logic analyzer
6) Two programmable power supplies
7) Single-channel voltmeter
8) Network analyzer
9) Spectrum analyzer
10) Digital bus analyzer

The heart of this unit is a Field Programmable Gate Array (FPGA). FPGAs are highly complex integrated circuits (logic blocks) that can be user-programmed. This is an over-simplification, but for this discussion, let's say an FPGA is a complicated, programmable IC that can be used to control other circuits.

And since the Analog Discovery 2 is interfaced to a computer, the measurements can be captured and stored. There is a special "ham radio package" version of this unit, which includes several accessories to enhance using the unit. This may be a limited-time offer, so check the website to verify. It's called the "Ham Radio Workbench Bundle." Go to <https://store.digilentinc.com>.

Of course, this article would not be complete without mentioning the Arduino and Raspberry Pi. *Photo L*

Photo J. The Analog Discovery 2, top view. This is a multi-function test instrument in a box that fits in the palm of your hand. It connects to a computer via a USB port.

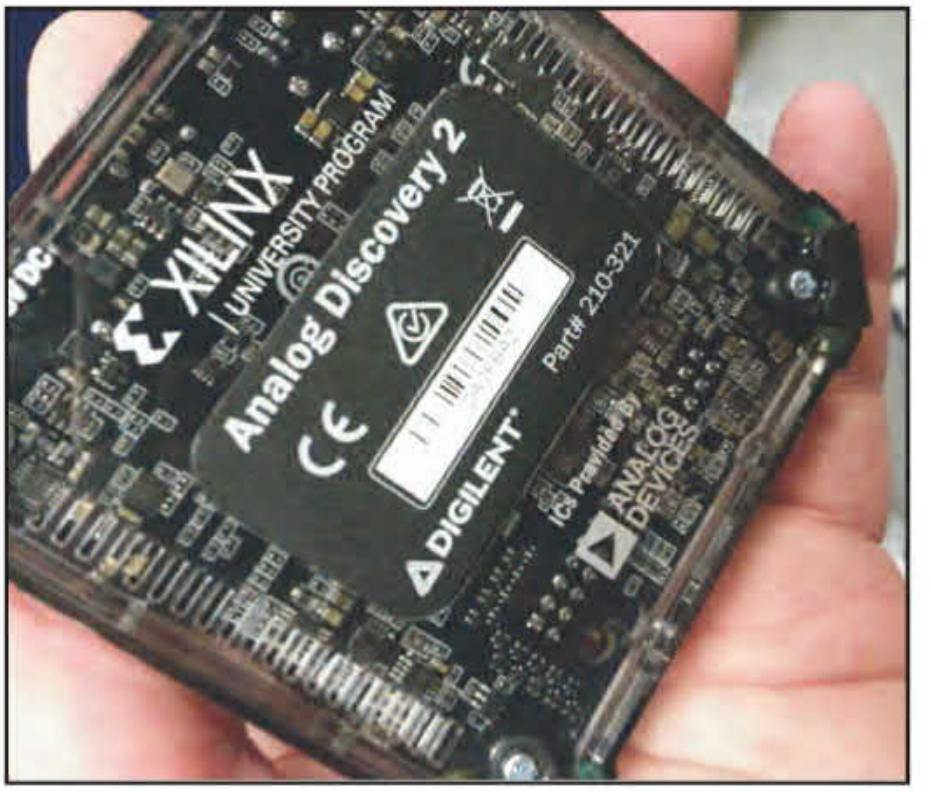

Photo K. Bottom view of the Analog Discovery 2.

shows another project under construction. It is a BITX40 SSB transceiver. There are many references to this "Raduino" so I won't repeat too many things here. It is a great example of how a microprocessor can be used to simplify and shrink a variety of circuits and functions.

These are just a few personal examples of projects, products, and technologies from the not so distant past and today. I don't know about you, but looking at the changes over my "ham lifetime," I am looking forward to what's coming next!

– 73, Wayne, KH6WZ

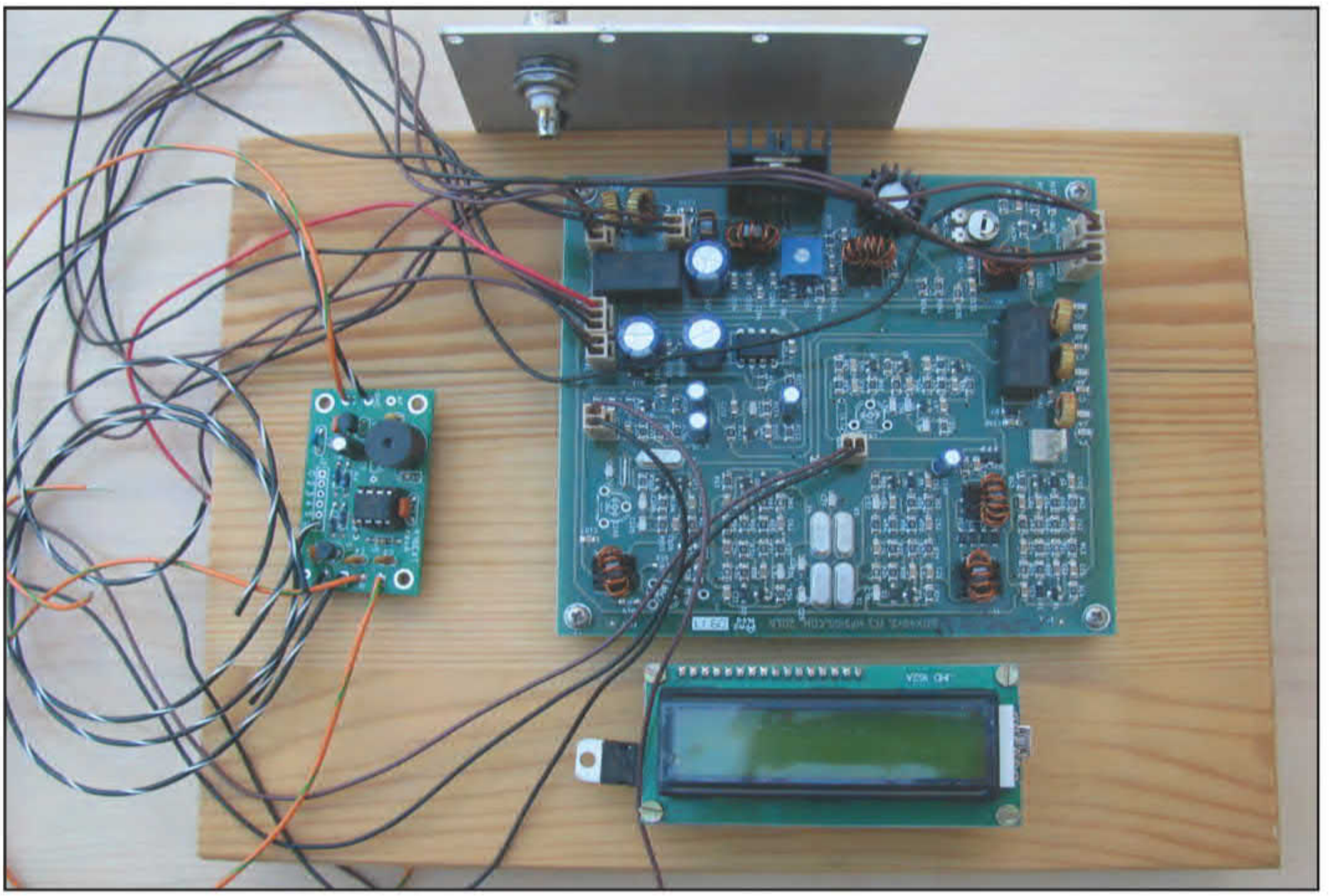

Photo L. My version of a BITX40 SSB transceiver, still under construction. It's a great example of how a µP can simplify various circuits and functions.

DIGITAL CONNECTION

BY DON ROTOLO,* N2IRZ

High-Speed Packet Making a Comeback

Happy New Year 2020. I hope this year is better for you than any other year so far.

My first experiences with digital radio were in the early years of packet radio. Tucson Amateur Packet Radio (TAPR, <www.tapr.org>) had just come out with the Z80-based TNC-2 terminal node controller, the network protocol wars had not yet heated up, and *CQ Amateur Radio* magazine wasn't even 35 yet. What interested me the most was how running a relatively slow digital data network could teach you how networks work, which was something I found valuable in my professional life. Other aspects of networking, such as antenna selection, fade margins, packet routing, and site selection were just icing on the cake.

As packet radio matured, we saw several innovations, particularly in the modem (MOdulator-DEModulator), the hardware that produces and decodes the actual audio signals to and from the radio. Most packet links used the Bell 202 modem, developed for use with telephone systems, typically at 1,200 baud, but with a minor tweak could be made to work at 2,400 baud. We then saw the G3RUH modem (and several clones) for 9,600, 19,200, and higher, the Hamilton Area Packet Network's HAPN-T at 4,800 baud (which works well on phase-modulated radios), and even the GRAPES modem at an astounding 56k baud, to name but a few. For these higher-speed modems, the biggest problem was finding a radio that could handle the signals without distortion.

Alas, finding radios that have the characteristics to support high-speed data remains difficult today. There are some commercial radios optimized — or at least usable — for high-speed data, with several offerings in the used market. These have their own issues, though, and testing shows that not every "9,600 Baud Ready" radio really is.

Photo A. A prototype NinoTNC, installed in a plastic case, as part of a test link at Tadd Torborg, KA2DEW's, house. The link managed over 300 bytes per second. (Courtesy of Tadd Torborg, KA2DEW)

This Month

This month, we will start a short series of articles on high(er) speed data. As promised in November's issue, we'll touch on the new 9,600-baud KISS TNC developed by Nino Carrillo, KK4HEJ. But instead of a deep dive into all the details, this month we will explore details of the hardware and firmware design, and in March, what to look for in a radio, and get into practical aspects of connections and making this actually work on the air.

The first test batch of Nino's TNCs was released in August 2019, and based on practical testing (see *Photo A*), several design changes were recommended. At the time of this writing (November 2019), these changes are not yet completed, so I decided that instead of introducing hardware that was going to be the subject of considerable changes, the focus would be on design.

Packet Comes Back

Long after the death of packet radio from internet poisoning, packet radio networking continues to grow (see <www.tarpn.org>), and some networks have links that are starting to approach saturation at 1,200 baud. One easy solution to this problem is to swap in a higher-speed link.

I've written about the TARPN system a few times previously, as this represents the ideal way to go about packet networking: Only a few simple rules, including mandatory use of dedicated point-to-point links, and anyone who wants to use the network has to have some skin in the game. This makes the network both robust and sustainable. The network was designed to be both transparent in operation, and highly inspectable, making it very easy to see how things work "behind the scenes" — in other words, as an educational tool that is also valuable as a data network.

When Nino announced his KISS TNC for 9,600 baud on the TARPN user group <https://groups.io/g/tarpn> last August, I was immediately interested. Since then, several test units have been in the hands of a few TARPN operators and the project is now being redesigned for its second iteration of circuit boards. Nino reported end-to-end transfer rates of about 600 bytes per second under ideal conditions, quite a lot faster than a good 1,200-baud link.

Of course, the performance of this (or any) modem very much depends on

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having a proper RF path and configuration. If you set up a 9,600-baud link that suffers from Hidden Transmitter Syndrome, throughput can easily fall below that of a 1,200-baud link. A dedicated point-to-point link with sufficient signal strength is needed to have any chance of getting the performance you are paying for in the link.

Intended for use with a TARPN node controller running on a Raspberry Pi microcomputer, the KISS interface offers flexibility to use the TNC in almost any packet system, including standalone as a user terminal.

A Redesign

The issues found with the first batch of hardware were primarily things like physical compatibility for mounting and nonstandard electrical connections. So the board layout is being changed to have the mounting holes match up with the TNC-PI from Coastal Chipworks <www.coastalchip.com>, making it easier to mount in a standard TARPN box, and the addition of a DE-9 connector to be again compatible with the TNC-PI. It seems this is becoming a de-facto standard, even though this configuration has been around for a long time (see *Photo B*).

Some differences include the omission of I2C bus support — not a priority at the moment — and its ribbon cable, in favor of a USB connection to the Raspberry Pi using a mini-USB on the TNC. The TXDelay potentiometer is removed in favor of a software-only setting. The TNC-PI can use either software or the on-board potentiometer R6 to adjust TXDelay. And, particularly valuable in the development stages of most any project, additional status LEDs (my personal favorite is the one named "Stranger" – see *Photo C*).

The goal here is to make everything both easily reproducible and turn-key. For example, even though the GRAPES 56k modem was an astounding achievement for its time, not many of them were actually placed into service. The main reason for that was the requirement that a transverter be used for the RF stage, made necessary by the lack of radios that could actually transmit and receive a signal that wide. So the GRAPES modem was designed with its RF output at around 30 MHz, and a transverter (with its naturally wide bandwidth) was used to up-convert the signal to a band where 56k was both useful and legal.

The lesson learned from this and several other examples is that if the user needs to modify something to make it work, acceptance and usage will suffer significantly. So far, a TARPN node is completely off-the-shelf turn-key, with the exception of trivial things like the cable connecting the TNC to the radio and putting up antennas. Oh, and maybe the wooden box in which to mount a node, but it's just a convenience thing, not really required.

Photo B. A DE-9 female connector, the de-facto standard to interface a TNC with a data radio. My first experience with this configuration was on the TEKK KS-900 data radios. Pin 1 is data to the radio, Pin 2 is ground, Pin 4 is PTT and Pin 5 is data from the radio. (Courtesy of Wikimedia)

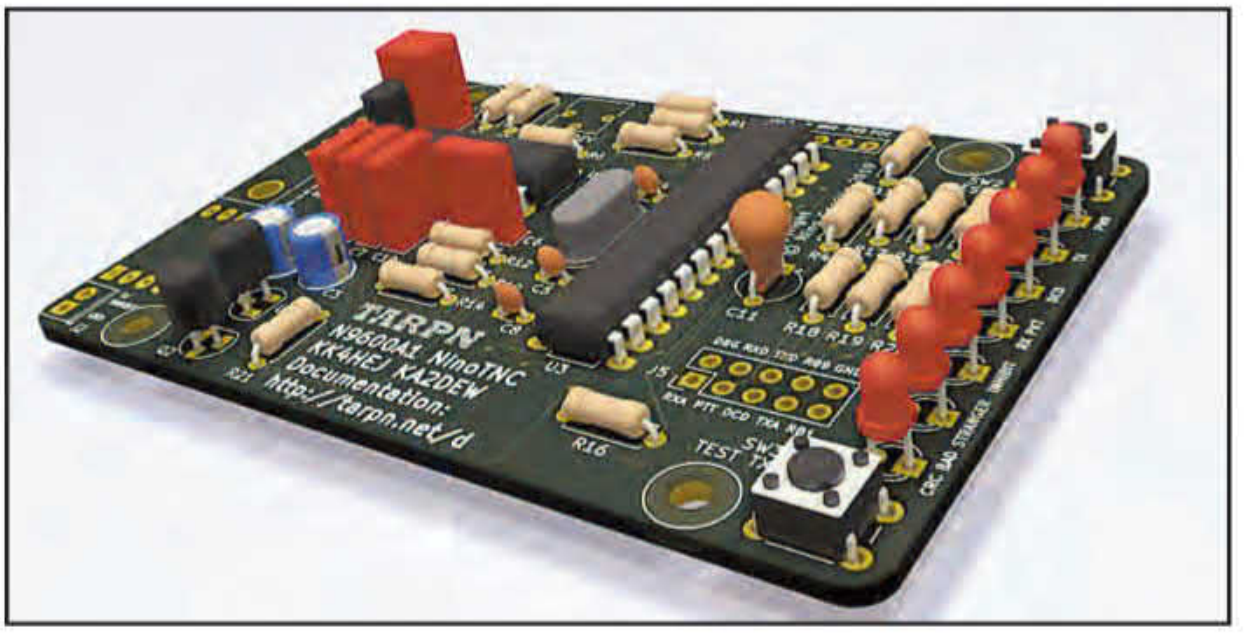

Photo C. A rendering of the NinoTNC that is close to what's being designed. Not installed are the connectors for the host Raspberry Pi and the radio interface, a DE-9F connector. The heart of the system is the dsPIC IC seen in the center. (Courtesy of Tadd Torborg, KA2DEW, and Nino Carrillo, KK4HEJ)

9,600-Baud Radios

With this new TNC, a few hurdles remain to the entire system being turn-key, most importantly the selection of and connection to a compatible radio. You see, testing shows that several modern radios marketed and advertised as 9,600-baud ready, aren't. The details of this will be covered in another month, as it is too large to fit here today.

Hardware Design

The fundamentals of the design aren't changing much, so let's take a good look at what we have. Before we start: If there is something you don't recognize or understand, take a moment to look it up on the internet. You will find yourself understanding all this in greater detail, which will greatly increase your appreciation and satisfaction with what we are discussing. I just don't have the space to explain every detail, sorry, but I'll give it a try.

Nino's design uses a dsPIC from Microchip <www.microchip.com>, which is a 16-bit PIC microcontroller that incorporates DSP (digital signal processing) functionality and features low power consumption. The circuit board uses through-hole components to allow for easier construction.

The modulated data for the transmit (TX) chain out to the radio comes from the output of the dsPIC's DAC (digital-to-analog converter), which is filtered using a low-pass fourth-order Bessel filter implemented in two op-amps to produce a clean waveform. A potentiometer is inserted into the signal path to allow the signal level to the radio to be adjusted, which sets the transmit deviation. As most anyone working with digital signals knows, excessive deviation

seriously degrades the signal quality, dramatically reducing the ability of the receiver to decode incoming data.

On the receive side, a simple high-pass filter, with an op-amp buffer, centers the incoming audio stream in the dsPIC's ADC (analog-to-digital converter). What this means is that the input range of the ADC is limited, and this circuit scales the incoming audio to ensure nothing gets overloaded or out-of-range. This allows the design to handle a wide range of receive audio input levels. The ADC then converts the audio to a digital bit stream for processing and decoding.

PTT (push-to-talk, switching on the transmitter) is handled by a simple 2N700 FET (field-effect transistor) circuit. The circuit also contains a simple power supply to convert the main 5-volt supply to 3.3 volts for the dsPIC and serial data systems. In the first prototype, screw terminals were used for the radio connections, but in the redesign this will be a DE-9 connector in the standard configuration. There is a test button to generate a tone to help with setting deviation. A few LEDs are included to help the user understand system status and operation, and as I mentioned above, the redesign will add a few more.

Firmware

The dsPIC is used to packetize the KISS data from a host — the Raspberry Pi in the case of a TARPN node, but it doesn't have to be that — into standard AX.25 format, including bit-stuffing (a way of ensuring the digital signal doesn't have too many 1s or 0s in a row), CRC (cyclic redundancy check, a way of helping ensure data integrity) and scrambling (to make the signal seem more random, making transmitting and receiving more robust). The output waveform is then generated using the dsPIC's output compare module as a 9-bit PWM (pulse-width modulated) DAC running at nine times the baud rate. The waveform is smoothed with a Gaussian FIR pulse-shaping filter, and this output from the dsPIC is fed to the previously mentioned low-pass Bessel filter to integrate the PWM pulses, forming a smooth analog waveform which is fed to the transmitter. The transmit signal level adjustment potentiometer is buffered by an op amp in the transmit chain.

For reception, the filtered and level-adjusted receive analog audio is converted into a digital bit stream by the dsPIC's ADC, sampling at five times the baud rate. Recovery of the clock (and data) is implemented in the dsPIC using peak-detection and zero-crossing detection. DCD (data carrier detection, important for running open-squelch) is performed by evaluating the clock sync. The data is un-scrambled, decoded, bit stuffing is removed and CRC validated. If all is well, the data is forwarded to the host microcomputer either over the USB port or the serial port. As mentioned previously, unlike the TNC-Pi, the I2C serial link simply isn't fast enough to be used for this.

The TNC as implemented understands all standard KISS-PARM settings (such as TXDelay and PACLen). The firmware does not implement the transmit-deviation adjustment, even though it could, only because the adjustment is far easier and more intuitive with a screwdriver and trimmer potentiometer. Pressing the "test" button causes the TNC to transmit a 998-Hz tone so the deviation can be set. The 998-Hz tone is used because it allows setting the perfect minimum-shift deviation by finding the first Bessel filter null, which occurs at a point where the tone frequency is multiplied by 2.405, which is 2,400 Hz.

Setting the deviation correctly is important. A 2,400-Hz deviation is ideal, and while a somewhat smaller deviation is not terribly harmful, a somewhat larger deviation will introduce distortions into the transmit chain that will significantly degrade the link's performance. Of course, the ideal would be to have a deviation meter, which provides an objective number for the deviation. But there are several alternatives, which we'll discuss another month when we talk about connecting this to a radio.

In March, I expect the second generation of this project will have progressed enough to discuss the practical aspects of getting it on the air, along with selecting a suitable radio. In the meantime, go check out the TARPN documentation page for this TNC at <tarpn.net/d>. I am also hopeful that plans to make these more widely available will be formed, but with that I can't make any promises. Remember the desire to make everything turn-key, and as with many of us, operating a business that builds ham radio TNCs and modems might interfere with our day job. We'll see. – *Until then, 73 de N2IRZ*

Photo D. A 56k GRAPES modem. Note that it is called an RF modem: The output was not at baseband (audio) but at around 30 MHz, requiring a transverter to place the signal on a legal frequency. This complexity was the primary challenge to its widespread use. (Courtesy of Dale Heatherington, WA4DSY)

Photo E. A HAPN-T 4,800-baud modem atop my ICOM IC-45A. To operate at 4,800 baud, the radio required a minor modification to tap into the discriminator output and modulator input, which are brought out (along with PTT) on the DE-9F connector shown. Such modifications scared many packeteers away from anything faster than 1,200 baud.

MF/LF OPERATING: Life Below the AM Broadcast Band

BY JOHN LANGRIDGE,* KB5NJD

Using Scopematch to Resonate and Match Your Low-Band Vertical Antenna System

Plus, more records come and go on 630 and 2200 meters and K3MF does his part to educate prospective MF and LF ops in southern Pennsylvania

This month's discussion begins with a description of real-time monitoring of antenna impedance (both resistance and reactance) while transmitting. While an antenna analyzer is an essential tool for implementation and practical setup of a reactive antenna system that would commonly be used at medium-wave (MF) and longwave frequencies (LF), it is advantageous to have feedback on the state of the antenna and feed line while on the air.

Amateurs commonly observe standing wave ratio (SWR) via a simple metering circuit, often believing that a one-to-one value means that all is well at the antenna and on the feed line itself. All may, in fact, be in order but when a one-to-one SWR is not achieved, what next? Impedance is a complex value made up of resistance, R, and reactance, X. Often, adjustment of reactive antenna systems then becomes a matter of trial and error, as the amateur hunts for the minimum SWR value. In simple terms, SWR is really only a way of representing the magnitude of reflection coefficients and does not readily gives clues about whether the problem contributing to a high SWR measurement is due to the resistance, reactance, or a combination of both. However, the astute amateur may be able to arrive at educated guesses based on the antenna. I have watched amateurs during Field Day spend hours trying to resonate and match low-band verticals using an SWR meter as the measuring stick. It was an exercise in futility and dumb luck.

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Enter the Scopematch

In 2003, Jim Moritz, MØBMU, published an article[1] entitled "LF Tuning Meter for the 136 kHz Band" which first introduced some of the concepts, challenges, and solutions associated with impedance measurement of reactive antenna systems used on the low bands. In the years since, those solutions have been expanded for use on 630 meters and

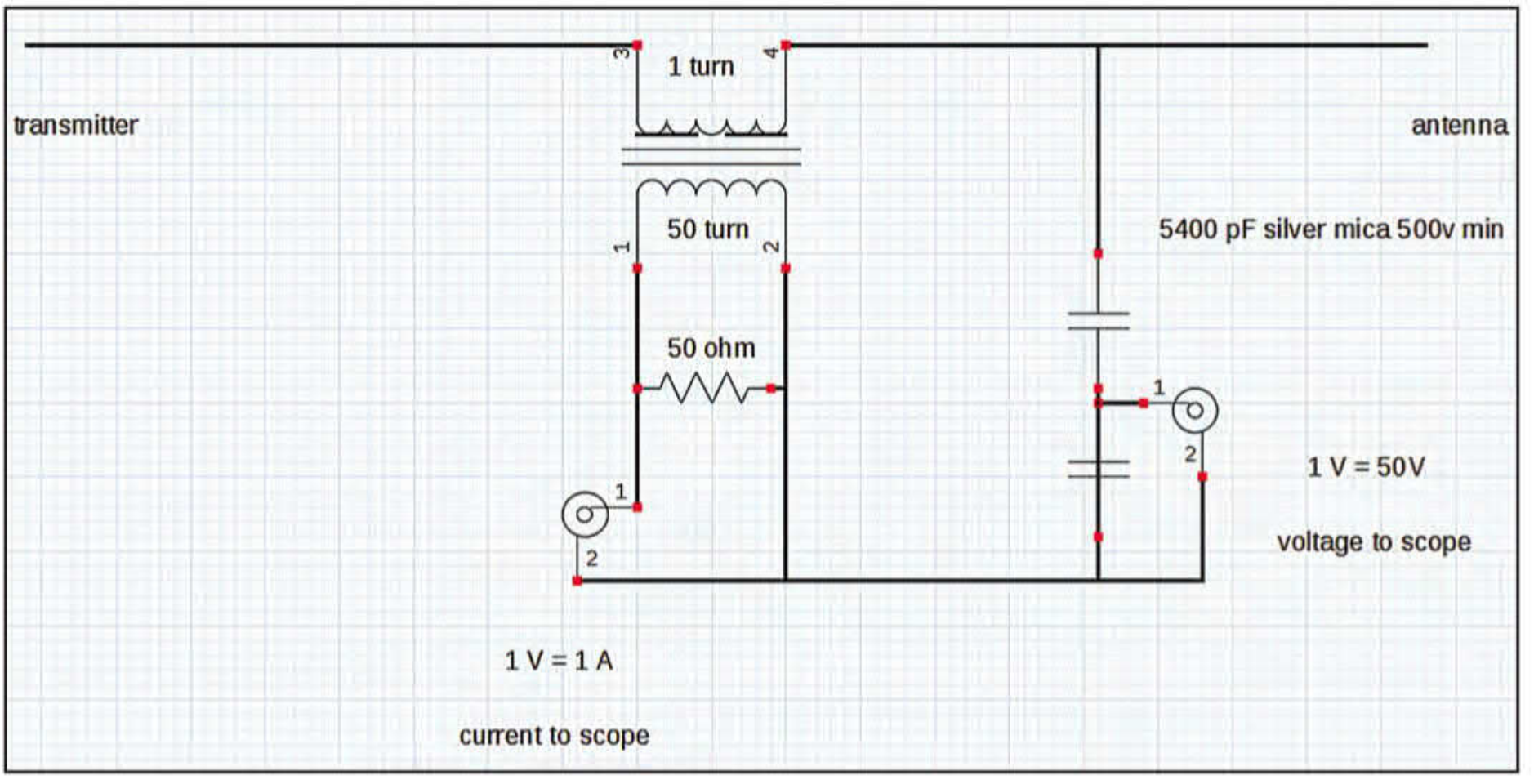

Figure 1. Scopematch works by sampling voltage and current from the feed line between the transmitter and antenna. By examining these values on a 2-channel oscilloscope while transmitting, and applying a bit of theory, it is possible to make decisions about how an antenna should be adjusted. Unlike an SWR meter, the Scopematch provides useful information about resistance and reactance based on the phase and amplitude of the waveforms produced.

there is no reason that the same concepts could not be applied at 160 meters and high frequencies as well.

Scopematch is one of a few elegant solutions described by MØBMU to this problem of on-air impedance measurement. One of the features that makes this approach so attractive for the end user is that there are no numbers involved, instead a graphical representation of voltage and current are viewed on a 2-channel oscilloscope on which the relative magnitude and phase of each measured waveform determines the state of the impedance. When both waveforms superimpose on one another to appear as a single sine wave, the system is resonated and purely resistive, which is a state that maximizes antenna current.

At resonance, applied voltage and current are said to be in-phase, which can be measured with a current transformer and capacitive divider network, respectively (*Figure 1*). Displayed simultaneously on a 2-channel oscilloscope, the result is two waveforms that occupy the same time domain when at resonance. A concept that is often not spoken of in modern times but was, at one time, tested for on amateur radio exams was "ELI the ICEman." Using the traditional variables for current (I), voltage (E), inductance (L), and capacitance (C), the mnemonic device expresses that when voltage (E) leads current (I), the system is inductive (L), hence "ELI". When current (I) leads voltage (E), the system is capacitive, hence "ICE". The

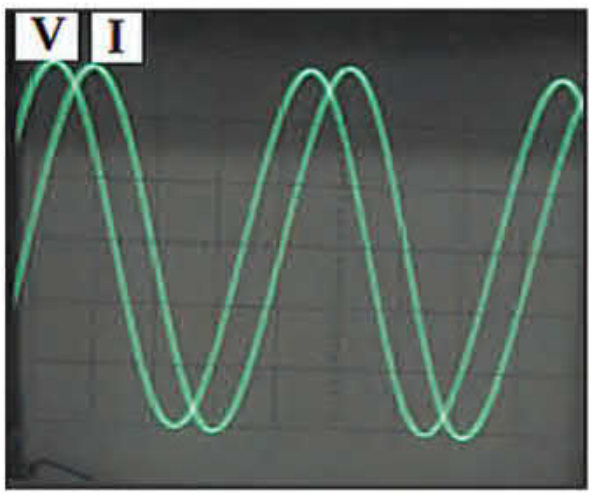

Photo A. Voltage leads current, so the system is inductively reactive and needs capacitive reactance to achieve resonance. Both sine waves show equal magnitude, so the 50-ohm set point has been achieved.

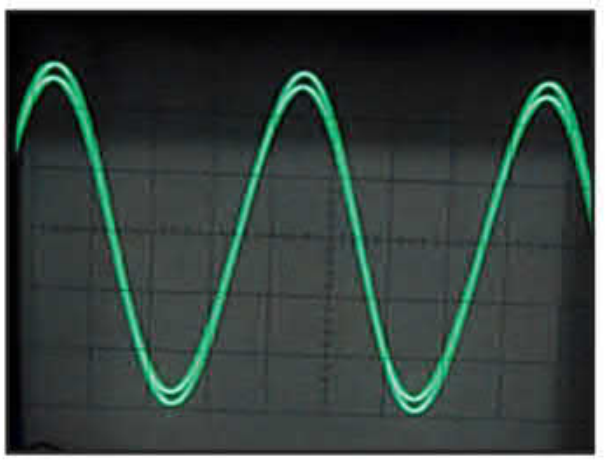

Photo B. Both sine waves are in-phase so resonance has been achieved. The voltage is of slightly higher magnitude than current, therefore the resistive portion of the complex impedance is above the 50-ohm set point.

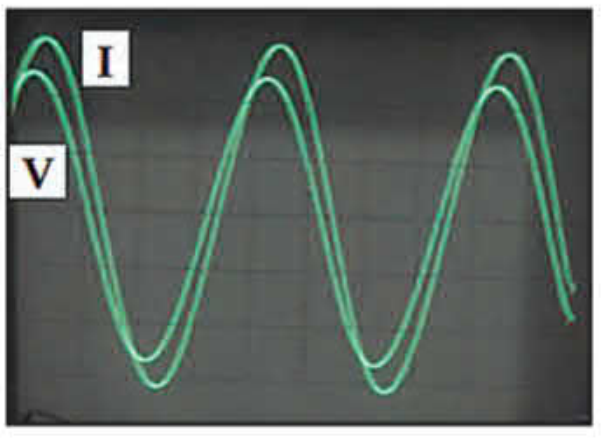

Photo C. Voltage leads current so the system is inductively reactive and the magnitude of the current sine wave is higher than that that of the voltage, so the resistance is below the 50-ohm set point.

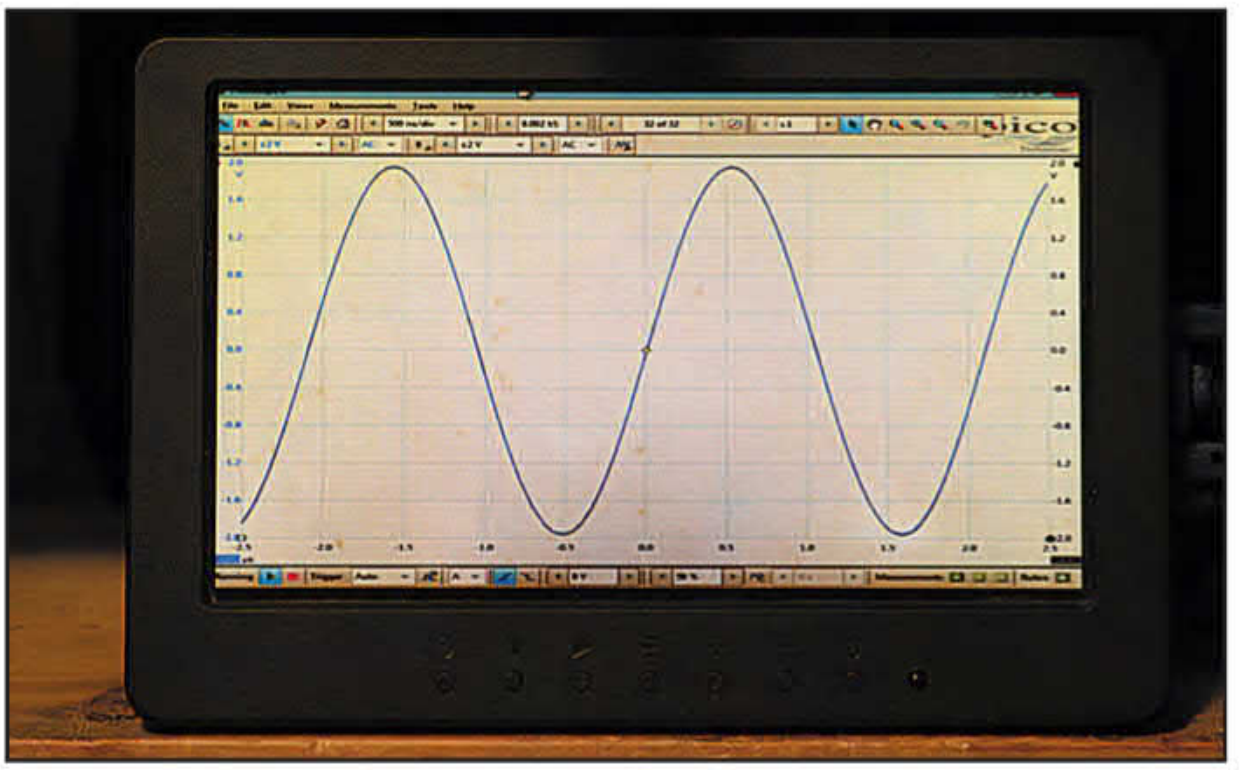

Photo D. This is the 7-inch LCD screen that K5DNL uses with his Picoscope. In the image, the antenna is both resonated and matched since both sine waves appear as one when superimposed. (Courtesy of K5DNL)

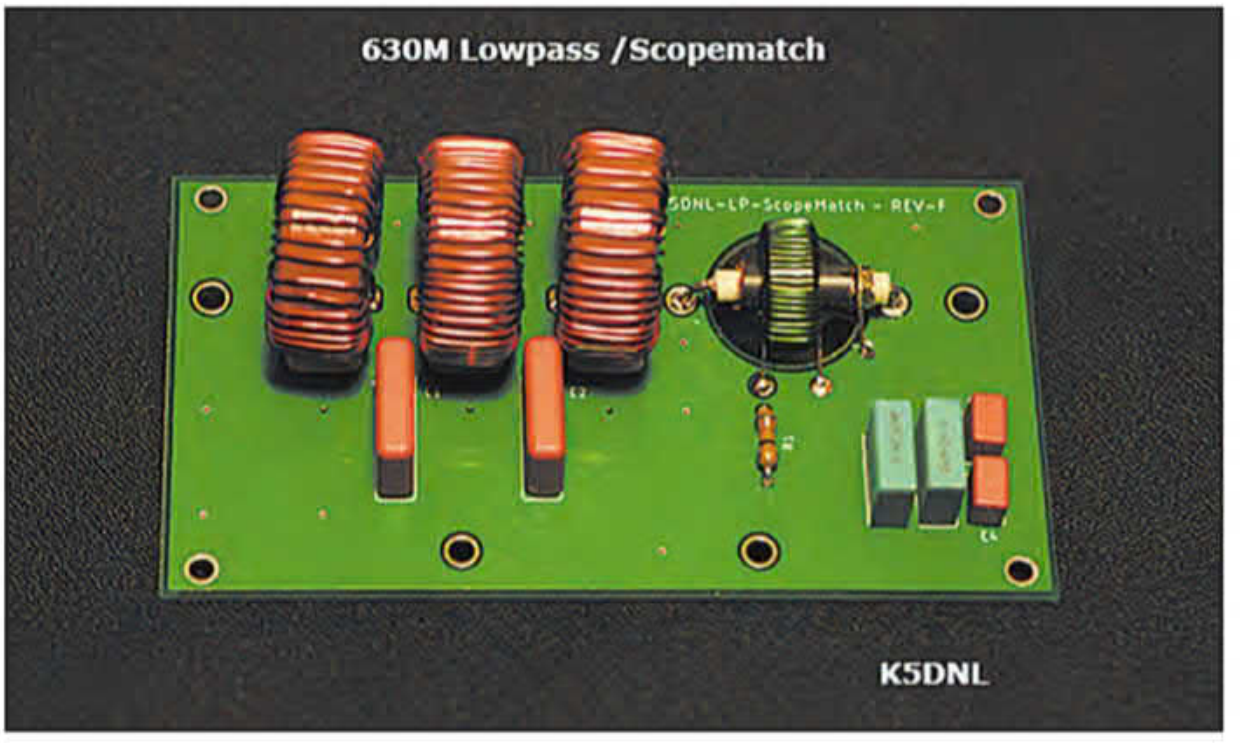

Photo E. K5DNL produces a commercial low drive 100-watt output class-D amplifier with an outboard combination low-pass filter and Scopematch sensor package. (Courtesy of K5DNL)

Photo F. While testing a new Scopematch system with power applied to a known resistive load of equal design set point resistance, if the current and voltage sine waves are 180° out of phase, simply trade the transformer connections. (Courtesy of KR7O)

word "leads" expresses the relative positive of one waveform to the other with respect to time domain. (*Photos A*, *B*, and *C)*

Amplitudes of the signals may or may not be the same, which describes the resistive portion of the impedance with respect to a load resistance that the output of the current transformer terminates. Typical values of the termination resistance are 50 ohms but can be customized to a set point at design and build time to the characteristic impedance of feed line and transmitter.

When the amplitude of the measured voltage is higher than that of measured current, we say that the resistive portion of the impedance is above the set point. Again, in most cases, this set point will be 50 ohms. So in this example, the resistance is above 50 ohms. Similarly, if the amplitude of the current measurement is higher than that of the voltage measurement, we say that the resistive portion of the impedance is below the set point. Absolute values are irrelevant in this case and we only seek to make adjustments so that what we see on the oscilloscope is a single waveform in spite of two waveforms being present. There is really nothing easier.

When implemented with remote tuning located at the antenna, Scopematch allows the operator to rapidly traverse frequencies and maximize antenna current while minimizing final amplifier stress often associated with mismatch and out-of-resonance conditions. I've spoken in the past about my station and how I utilize a motorized variometer to control the resonance of my system while a motorized vacuum capacitor, connected to a tap of the variometer and leading to ground, gives me control and fine-tuning capabilities of resistance and reactance. This capability, in conjunction with the Scopematch tool, gives me ultimate flexibility while I am on the air. Being able to dynamically control the tuning of the antenna system is very important, even if the operator generally remains on the same frequency (using WSPR, for example) because many variables can change through the course of an operating session that can result in a mismatched condition. This is especially true at this time of year when winter weather can rapidly change ground and environmental conditions in the vicinity of the antenna.

One comment that seems to arise from time to time is that many operators do not own an oscilloscope or perhaps do not feel like they have room at their operating position for a bulky instrument. I can certainly relate to the latter as my Scopematch oscilloscope is a very large Tektronix 453 that sits on a side desk at the operating position. I have a smaller oscilloscope on the work bench, a Tektronix TDS-210, but space has never really been a problem and the older, bulkier oscilloscope meets my needs well.

For someone with this dilemma, however, there are some options on the market that solve the problem. Ken Roberson, K5DNL, recently described his Scopematch system, which is comprised of a 10-MHz, 2-channel Pico 2204A USB computer oscilloscope[2] and a 7-inch LCD monitor, both of which are available on Amazon for an attractive price (*Photo D*). This compact approach has been very reliable and space-efficient, to the point that Ken even recommends these products for use with a 630-meter amplifier, low-pass filter, and Scopematch combination that he manufactures for the amateur market (*Photo E*).

For those interested in building the Moritz version of the Scopematch tool, there is one design and construction time pitfall: When initially testing a new Scopematch build, if you find the current and voltage are 180° out of phase into a known non-reactive load, simply reverse the leads on the current transformer. Robert Brown, KR7O, experienced this problem in the 2018 / 2019 season while accessorizing his station. Fortunately, his construction style made solving the

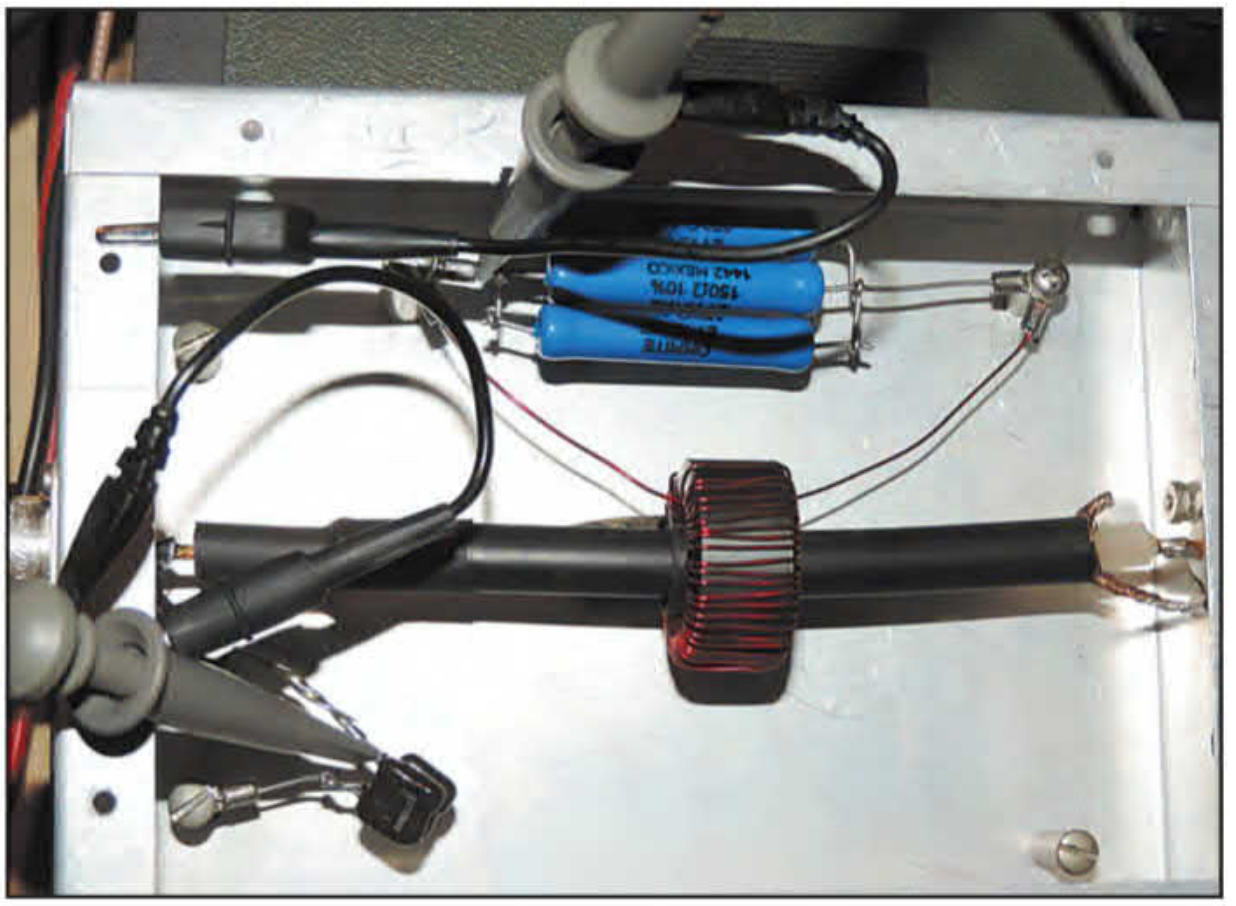

Photo G. KR7O's Scopematch implementation allowed for easy trading of transformer leads when initial tests showed his measurements were 180° out of phase. (Courtesy of KR7O)

Txmtr	Rcvr	Band	Mode	Distance	Time (UTC)
VK4YB	KL7I	2200m	JT9	11138 km	11:52:50
VK4YB	VK3QD	2200m	JT9	1387 km	11:52:50
VK3QD	VK4YB	2200m	JT9	1387 km	11:47:50

Photo H. While several long WSPR receptions have been reported on 2200 meters, the longest using JT9, a popular QSO mode, was reported by VK4YB following a reception at KL7L very early in the season. A two-way contact is probably forthcoming. (Courtesy of VK4YB)

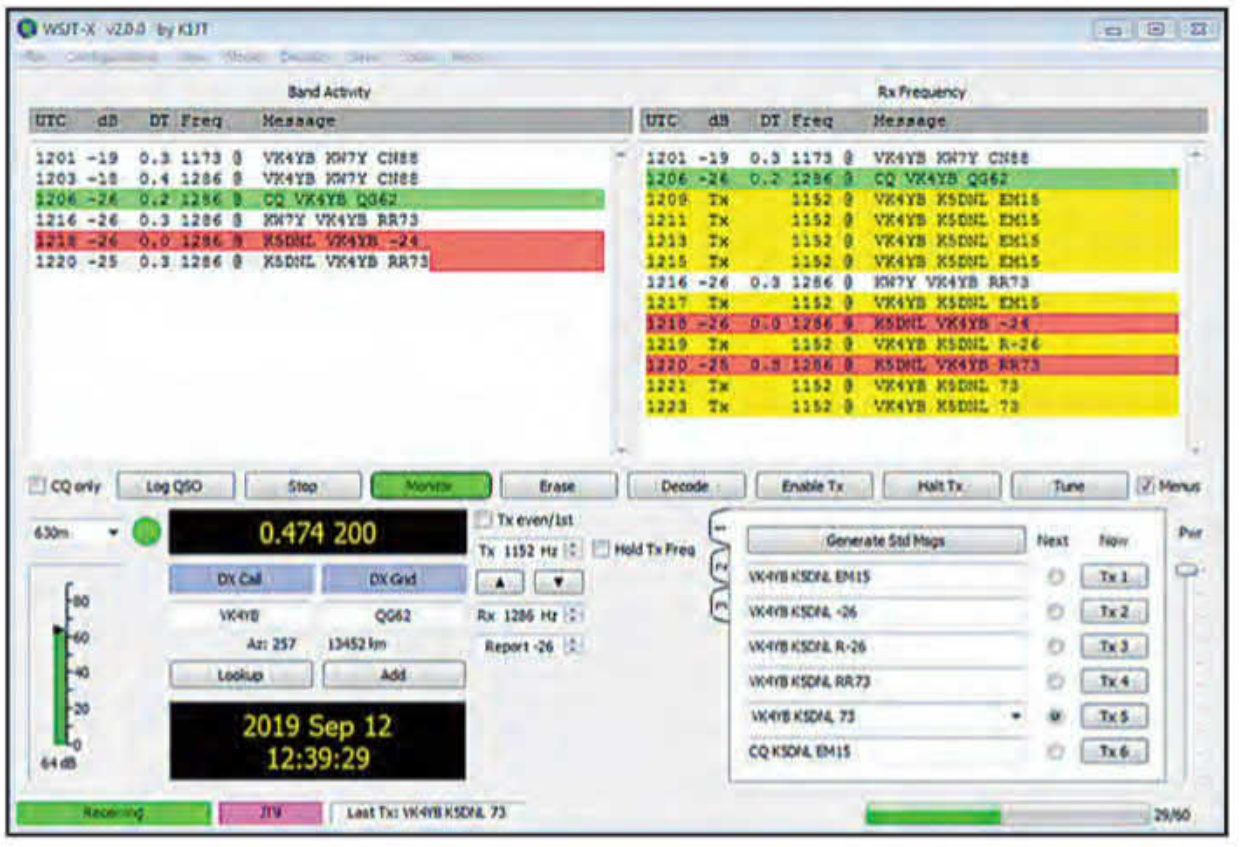

Photo I. K5DNL completed a distance record JT9 QSO with VK4YB just minutes after KW7Y completed his first trans-Pacific JT9 QSO with VK4YB. (Courtesy of K5DNL)

problem very simple. He simply traded the connection points of the transformer leads (*Photos F* and *G*).

The updated Moritz article also includes versions of an impedance meter that utilizes physical meter movements to display phase and amplitude variations of current and voltage. Those other versions and variations of the Scopematch tool are certainly more suitable for portable operation and might be of interest for the builder. The simplicity of the traditional Scopematch is an important consideration for many, however.

More Distance Records Fall!

The start to this season was busy as a few more distance records for QSOs or receptions have come and gone. On September 11, 2019, Roger Crofts, VK4YB, indicated that the most distant JT9 reception report ever recorded for 2200 meters was observed between his station and that of Laurence Howell, KL7L, at a distance of 11,138 kilometers (6921 miles) (*Photo H*). While more distant reports have been observed using WSPR, this is a highly significant accomplishment as it suggests that QSOs may be possible over those distances on 2200 meters. In fact there is so much confidence in the presence of these openings that recently, Ward Wheaton, K7PO, of WH2XXP fame, has been monitoring the trans-Pacific path on 2200 meters in hopes of catching Roger for a new QSO and subsequently a new entity on 2200 meters.

On 630 meters on September 12, 2019, a lucky JT9 QSO was completed between Ken Roberson, K5DNL, and Roger Crofts, VK4YB. Ken noted that he was in the right place at the right time which adds support to the notion that there is no substitute to being at the operating position and in the operator seat when openings are possible (*Photo I*). A number of stations are in contention in the eastern portions of North America to break this most recent QSO record and by the time of publication, a new record may have already been observed so stay tuned (*a new record has been set, more in my next column –JL*)!

A Previously Unobserved Path Opens!

On September 13, 2019, Stephanie Spirat, VK5FQ, was reported by Pascal Deveaux, FR5DH, of Reunion Island in the southwestern Indian Ocean while making WSPR transmissions on 630 meters. While Pascal's reception reports have been in the spotlight in recent

years due to numerous receptions on trans-African paths to Europe on 630 meters, this opening to Oceania is a first of its kind under amateur radio rules (*Photo J*).

The path suffers from complications associated with ample common darkness in addition to high noise levels. Stephanie's saltwater path to FR5DH is certainly beneficial as other large and capable stations in the East where the path is largely land based, such as VK4YB, have yet to replicate the feat.

This path may be a relatively easy from VK6 in western Australia but further experimentation is necessary.

Growing Activity Through Grassroot Efforts

In the past I have mentioned the importance of active MF and LF operators being involved in the amateur community, proselytizing that which we do every chance we get. For some that might mean giving presentations or writing articles and

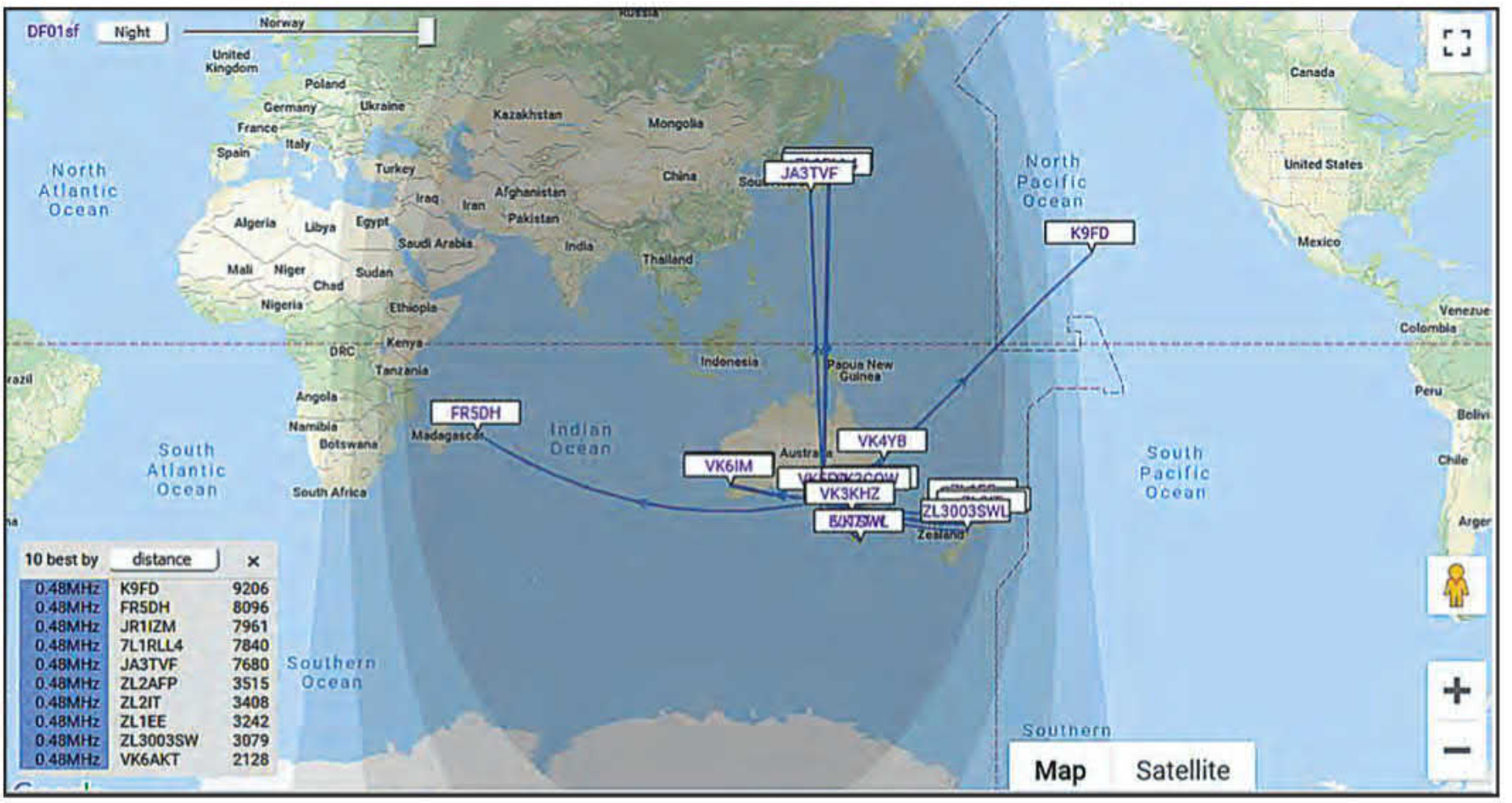

Photo J. FR5DH on Reunion Island reported the first transmissions on the long-haul path across the Indian Ocean from VK5FQ in Adelaide. This difficult path from Oceania has a limited window of common darkness and seasonally high noise. (Courtesy of VK5FQ)

Photo K. Wayde, K3MF, describes the antenna feed point and antenna tuning unit in a recent presentation to the Hilltop Transmitting Association in Felton, Pennsylvania. Wayde continued the discussion once it was dark in the club house, culminating in a number of completed JT9 QSOs with stations around North America. (Courtesy of K3MF)

books. In some cases, it might be a simple conversation at the weekly ham breakfast. And for others it might be something as simple as being on the air regularly. In October 2018, I reported that Wayde Batholomew, K3MF, had built a vertical antenna and matching network for 630 meters that he was donating, along with a Monitor Sensors transverter, to his local club, The Hilltop Transmitting Association, W3ZDG. Activity is finally being realized from the club station, as Wayde recently presented a talk and demonstration at a club meeting that resulted in several JT9 QSOs from around North America (*Photo K*). There seems to be considerable interest from this group so expect future growth from this region. It was all seeded from a simple presentation by K3MF.

So what are you doing to help advance the art of medium- and long-wave amateur radio? It does not take a lot of effort and as I just indicated, a simple conversation within a group of amateurs can have a significant impact. Fancy PowerPoint® presentations and dry erase boards are not necessary. Most of us got our start in this niche because someone planted a seed.

Finally, space permitting, I am going to feature an operator's antenna system at the end each article in order to help familiarize prospective operators with the types of systems currently in use in the active community. This month we look at the vertical antenna system of Tom Costa, N9RU, of Marion, Illinois. Tom recently rebuilt his caged-wire vertical antenna system following a failure in the supporting tree. Tom also re-purposed a small garden shed as an attractive enclosure for the BC-306a variometer that recently replaced a fixed-coil system. Tom noted that the measured antenna current on each loading method was the same. The caged radiator is 50-feet high with three top-loading wires spaced 3 feet apart and is 110 feet long. He feeds the antenna system against about 1,000 total feet of radials (*Photo L*).

That's all for this month. If you are not on the air, please consider spending some time there as spring and summer, and the noise that accompanies those seasons, will be upon us again very soon (even though it's January!). If you have questions or comments, please contact me at <KB5NJD@gmail.com>.

For your convenience the following links, in addition to bonus material, can be found at <http://njdtechnologies.net/cq>.

Links:

1. MØBMU article: https://tinyurl.com/y2ftvywn
2. Picoscope 2204A: https://tinyurl.com/y9row8ns
3. K5DNL Amplifier: https://tinyurl.com/yalcq5to

Photo L. This attractive antenna system at N9RU utilizes a 50-foot-tall tree, which supports a six-wire caged vertical with a 110-foot-long top-loading array consisting of three wires spaced 3 feet apart and fed against a radial system. A military surplus variometer resonates the system.

BY TONY EMANUELE,* K8ZR

2020: The Year Ahead From a VHFer's Perspective

VHF Plus Calendar

Quadrantids meteor shower: predicted peak January 3rd into January 4th
ARRL January VHF Contest: January 18th & 19th
DUBUS 144 MHz & 432 MHz EME contest: February 8th & 9th
DUBUS 3.4 GHz EME contest: March 7th & 8th

Looking ahead, the 2020 VHF+ calendar offers a wide range of operating activities, social events, and conferences over the course of the year. The year kicks off with the Quadrantids meteor shower peaking in early January, followed a few weeks later by the ARRL January VHF Contest on the 18th and 19th. In general, the winter months are not the best time of year for sporadic-E (E_s) or tropo so looking to the moon can result in a welcome increase in activity as the DUBUS 144- and 432-MHz EME Contests are scheduled for the weekend of February 8th and 9th, followed by the DUBUS 3.4-GHz EME Contest March 7th and 8th.

Three regional conferences will be held in April: The N.E.W.S. Group will hold its annual conference mid-month[1], the Northern Lights Radio Society Aurora Conference is slated for Saturday the 25th near Minneapolis, and the Southeastern VHF Society Conference in Gainesville, Georgia is also the weekend of April 25th. The CSVHF Society will again sponsor the Spring Sprints with the 144-MHz Sprint scheduled on Monday April 6th, the 222-MHz Sprint will be held Tuesday April 14th and a week and a day later the 432-MHz Sprint will take place. The ping jockeys will be busy during the predicted peak of the Lyrids meteor shower on April 21st into the 22nd.

For many, May means the annual pilgrimage to Ohio for the Hamvention® - this year on the 15th through the 17th. The VHF / UHF / Microwave forum at the Hamvention® not only offers an opportunity to participate in several informative presentations but also an opportunity for multiple eyeball QSOs.

Operating activities in the month of May include the Microwave and 50-MHz Sprints scheduled for May 2nd and 9th respectively. DUBUS will conduct its 10-GHz & up EME Contest the weekend of May 23rd and 24th.

June marks the start of the E_s season with the ARRL June VHF Contest on the 13th through the 15th. Historically the first week to 10 days of July offer the best chance of working Summer Solstice Short-path Propagation on 6 meters, providing a chance for stations located on the east coast of the U.S. to work into Japan and China.

The CQ World Wide VHF Contest is scheduled for July 18th and 19th – no excuse not to participate as most stations these days are equipped with gear for 6 and 2 meters. The very popular DUBUS 1.2-GHz EME Contest is also that weekend, with the month coming to a close with the 54th Central States VHF Society Conference to be held in Wisconsin July 24th and 25th.

Photo A. VK3CV's 122-GHz beacon. (Photos by VK3CY)

The dog days of summer can be the busiest of the summer with days at the lake, barbecues, the ARRL 222 MHz and above distance scoring contest the first weekend of August, the Perseids meteor shower with the predicted peak on the evening of the 11th into the morning hours of the 12th, the ARRL 10 GHz & Above contest mid-month and an increased possibility of tropo in general.

For many parts of North America, September is a transitional month. Propagation during the ARRL September VHF Contest on the 12th through the 14th can also be transitional in nature: A bit too late in the year for the summer E_s on 50 MHz and no guarantee of tropo, either. The only way to know for sure is to get on the air for the contest. The first weekend of the ARRL EME Contest shares the weekend with the ARRL VHF Contest. The second weekend of the 10 GHz & Above contest takes place on the third weekend of September with the date of the Fall Sprints, sponsored by the Southeastern VHF Society, yet to be determined at the time of this month's column deadline.

It is expected that over 200 microwave enthusiasts will make their way to the Washington, DC area to attend Microwave Update 2020 in Sterling, VA the weekend of October 17th. Many participants will arrive a few days early or stay a few additional days to take in the sights, including the nearby Steven F. Udvar-Hazy Center, the Smithsonian National Air and Space Museum's annex at Washington Dulles airport. Other events scheduled for October are the ARRL EME Contest's second weekend on October 10th and

c/o CQ magazine
email: <k8zr@cq-amateur-radio.com>

11th and the Pacific Northwest VHF Conference, its date TBD at this time.

With a new moon mid-month the Leonids meteor shower with its predicted peak November 18th into the 19th will light up the sky and hopefully 6 and 2 meters as well.

The final weekend of the ARRL EME Contest is scheduled for November 28th and 29th. The Geminids meteor shower with a predicted peak on December 14th will result in many staying up late into the night and into the early morning to take advantage of one of the year's most reliable meteor showers. Hopefully 2020 will close out with a bit of E_s on the Magic Band.

122 GHz Revisited[2]

At Microwave Update 2017, Mike Lavelle, K6ML, presented his efforts on adapting the Silicon Radar TRX120-001 transceiver integrated circuit into a working transceiver for the 122-GHz band. The TRX120 IC was developed for the 122-GHz ISM (industrial, scientific and medical) band for proximity and collision-avoidance radar applications such as depth measurement and speed sensing, to name just two. At 122 GHz, the device runs 1/2-milliwatt (-3 dBm) output with a DSB NF[3] of approximately 10 dB with in-package receive and transmit antennas, all on 8- x 8-millimeter[4] chip — pretty amazing. Mike was able to make short-range QSOs, less than a couple kilometers, with his system.

Photo B. Andrew operating 122 GHz from the Cerberus Car Park, in Black Rock, Victoria, Australia.

Future improvements include mounting the transceiver printed circuit board at the feed of a dish to take advantage of the antenna's gain on receive and transmit. The fact that the receive and transmit antennas are not in the same physical location on the TRX120 integrated circuit presents challenges. To that end, Mike has developed a mechanical system that physically moves the transceiver printed circuit board on transmit and receive to ensure that the correct antennas are at the focal point of the dish on both transmit and receive. Keep in mind that a wavelength at 122 GHz is only 2.4 millimeters (~ 0.1 inches.)

Building on K6ML's work, Andrew Anderson, VK3CV / WQ1S, recently developed a complete transceiver system for 122 GHz. It is based on the Silicon Radar TRA 120-002 IC. The subtle differences between the two ICs can be found at the Silicon Radar website. What is important to know is that Andrew's design includes all the components necessary for transverter operation with just an external I.F. receiver[5]. Equally important to note is that no external I.F. is required for transmit as all the transmit functions are implemented on the printed circuit board and in the firmware. The transmitter and receiver frequencies are separated by the I.F. frequency under the control of a programmable PLL.[6]

This approach is similar to one that was used during the early days of 10-GHz activity when wideband FM (WBFM) was the most common mode as the vast majority of the equipment for the band was based on surplus radar detectors or X-band door opener sensors. Back in the day, 30 MHz was a common I.F. and the surplus sensors were re-tuned to either 10.250 GHz or 10.280 GHz, i.e. 30 MHz apart. You

and your QSO partner would agree in advance as to who would transmit on which frequency. Modern advances in technology, i.e. a programmable PLL, eliminate that issue with the VK3CV 122-GHz transverter.

Additionally, I.F. separation ensures that the QSO is actually taking place on 122 GHz and not the I.F. frequency, which is possible with conventional transverter mixing topology if both QSO partners happen to be using the same IF. IF separation of the transmit and receive frequencies also allows for full-duplex operation in FM mode as the TRA120-002 IC is capable of simultaneous transmit and receive operation. Furthermore, the transceiver's design permits keyed FM tone, beacon-keyed FM tone, FM voice, keyed pseudo CW, and beacon-keyed pseudo CW. Pseudo CW is generated by shifting the transmit frequency, in other words Frequency Shift Keying (FSK). A major addition to the VK3CV design is that it includes a waveguide RF coupler that combines the separate transmit and receive functions of the IC into a common path, facilitating its placement at the focal point of a dish. For complete details see: <https://tinyurl.com/yyqbyr7s>. (See *Photos A* and *B*).

Tim Tuck, VK2XAX, has taken on the task of manufacturing Andrew's design and offering the transceiver and two different types of feed horns at a very reasonable cost to the amateur radio community. With nearly 100 North American amateurs set to receive transceivers in early 2020, the result will be an unprecedented increase in activity on the band. It will be interesting to review the results of the ARRL 10 GHz & above contest to see how many QSOs will be made on 122 GHz during the two weekends of the contest. The current North American 122-GHz DX record is a 114-kilometer (~70-mile) LOS contact by WA1ZMS/4 in EM96ur and W4WWQ/4 in FM07fm that took place in January 2005. That record is likely to be broken, given the number of VK3CV 122 GHz transceivers that will be on the air in 2020.

In the late breaking news department, an FCC Notice of Proposed Rulemaking (NPRM) proposes removing amateurs from the 3.3 to 3.55 GHz band. This is part of the effort by the FCC to make more spectrum available for the next generation wireless networks, commonly called 5G, mandated by the MOBILE NOW Act. More information next month.

Happy 75th CQ and Thanks

2020 marks the 75th year of CQ magazine. As is the case with just about any publication celebrating its 75th anniversary there have been a few ups and downs over the years. I am grateful to Editor Rich Moseson, W2VU, and Managing Editor Jason Feldman, KD2IWM, for the freedom given me to cover a wide range of diverse topics and activities related to VHF and beyond since becoming editor of this column. Here is to good health and good DX in 2020.

– *73 & CU on the bands. Tony, K8ZR*

Notes:

1) Check N.E.W.S. Group website for date and location

2) The January 2018 VHF+ column summarized the then-recent efforts by K6ML on 122 GHz

3) DSB NF: Double Sideband Noise Figure

4) 8 x 8 millimeters is approximately 0.315 x 0.315 inches

5) There is a 10-MHz (optionally GPS disciplined) VCTCXO reference included on the board as standard. If desired, an external 10-MHz reference can be used to improve the frequency stability. An optional 1-PPS (pulse per second) low-cost GPS receiver is used for disciplining the on-board 10-MHz reference.

6) PLL: Phase locked loop.

DX

BY BOB SCHENCK, N2OO

Chasing Old QSLs

How many of you have suddenly discovered that you needed a QSL for an old QSO for one thing or another? Perhaps for an award that you didn't chase back when you made the QSO. Or maybe you just were too busy to deal with QSL cards back then. Over the years, I have often been asked if I know how to get a QSL card for an old QSO. Let me give you a few pointers on how you might be able to secure that old missing confirmation.

There are many resources out there that you can use to help you along. Some are obvious. Some may require you to think like a detective. Let's start with the obvious. These are the ones that I use most often when I do research:

1) Look it up on QRZ. Yes, just search for the callsign in question on <www.qrz.com> and see what you find. Even some OLD calls are kept up on QRZ either by the actual owner of the call, or by the QSL manager. Also try <https://hamcall.net>. Sometimes different data can be found on different databases.

2) An excellent resource can be found within the DX Lab Suite that allows you to search an array of QSL Manager databases all at once. This includes IK3QAR, OZ7C, QSLinfo.de, hamcall.net, QRZ, and even some specific country call books (CBA). The URL is <https://tinyurl.com/wu8qadv>.

3) Bernie McClenny, W3UR, at Daily DX also keeps an up-to-date listing of QSL route resources. See <www.dailydx.com/qsl-routes>.

4) DX Summit. This is a DX spotting site that also allows you to do some searching into the past. If your QSO was made after January 1, 1997, then you can search for that call within a specific timeframe. I suggest using a relatively narrow timeframe of perhaps ±2-4 months and selecting the 1,000 spot amount at first. Searching on DX Summit is fairly straightforward and fun to play around with. Go to <www.dxsummit.fi>. Once you find the spots, scan through the comments for the QSL route.

5) DXSCAPE is another spot database site with a search feature that you can try. It's at <www.dxscape.com>.

6) GOOGLE! Yes, try googling the call. If too many responses appear, then try googling the call with the country name or some other specific search word or words.

7) Ham Gallery. Go to this super site maintained by Tom Roscoe, K8CX, and search for the QSL card you are trying to get. Look at the actual scanned card if it is in his database. See if a QSL manager is printed on the card. If you discover that the QSL manager is SK or no longer around, try looking for team member callsigns. There is a good chance that one of them knows how you might be able to get a QSL card, or at least a confirmation. Visit <www.hamgallery.com>.

8) DokuFunk <www.dokufunk.org>. The Research and Documentation Center for the History of Radio Communications and the Electronic Media is the world's biggest organization to collect, save, research, and present whatever relates to the history of radio communications, particularly amateur radio and broadcasting. Select your language in the upper right and enter the call that you are researching in the search box and see what appears. Follow the same guidelines as for Ham Gallery.

* *Email: <n2oo@comcast.net>*

Confirmations for long-ago QSOs might still be available … if the logs still exist and if you can figure out who has them. If you're looking for a card from one of Gus Browning, W4BPD's DXpeditions, though (such as this one from 1970), you're out of luck as the logs are believed to have been lost. (QSL photo courtesy K8CX Ham Gallery <www.hamgallery.com>)

9) Once you have acquired a list of clues, go back to QRZ and do some more sleuthing. Search team member calls and try emailing them to see if they can assist. Go back to the beginning of these suggestions and do the same for team member calls.

10) One thing to mention is that even if you would really prefer the actual QSL card, you can't be too choosy. If you actually do locate someone who still has the logs but no more QSL cards, then you have a couple of choices. You can make up a simple homemade QSL for the QSO needed and mail it to the person who holds the log. Ask him / her if you are in the log, and if so, to please sign the card and return it to you. You should add wording like "confirmed in the log of… by _____". Or something like that. Or, mail them your QSL card and ask them to simply sign it as "This QSO is verified in the log by_____" and mail it back to you. This should count for most awards.

You may just run into dead ends at times. You may discover that a log has been lost or trashed, especially old paper ones. If, along the way, you discover that an old log for a worthy DXCC entity is heading to the trash dump, consider offering to salvage it. If you are not able or willing, then pass along info about the QSL Managers Society to the log holder. There are many QSL managers around the globe who would be willing to make arrangements and take them over. Go to <www.qslmanagers.net>.

Are you a QSL manager? Be sure to take all precautions on how to save the logs that you are holding. Way too often, old logs are lost because family members do not know what to do with them after the QSL manager is unable to continue or he / she becomes a SK. Way too often, valuable DX and DXpedition logs have been trashed. I personally consider these old logs to be part of our DX history and should be saved one way or another. For example, I have occasionally been asked what happened to the log of Gus Browning, W4BPD. My research indicates that they are all lost. On the other hand, the Lloyd and Iris Colvin (YASME) logs representing some one million QSOs from the

CQ DX Field Award Honor Roll

The CQ DX Field Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 175 or more grid fields. Honor Roll lisiting is automatic upon approval of an application for 175 or more grid fields. To remain on the CQ DX Field Award Honor Roll, annual updates are required. Updates must be accompanied by an SASE if confirmation is desired. The fee for endorsement stickers is $1.00 each plus SASE. Please make all checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604.

Mixed

K2TQC.....288
W1CU.....267
VE7IG.....254
HAØDU.....253
OM3JW.....253
W6OAT.....249
IK1GPG.....245
OK1ADM.....244
HA5WA.....243
K8SIX.....240
HA1RW.....239
VE3XN.....239
I6T.....230
N8PR.....229
HA5AGS.....228
9A5CY.....227
K9YC.....227
WI8A.....227
VE3ZZ.....226
K8OOK.....225
KØDEQ.....221
HA1AG.....218
JN3SAC.....214
HA9PP.....213
WA5VGI.....213
W4UM.....210
N4MM.....208
OK1AOV.....208
F6HMJ.....206
KF8UN.....205
OM2VL.....205
VE7SMP.....204
RW4NH.....203
IV3GOW.....201
HB9AAA.....200
N5KE.....200
W3LL.....199
K1NU.....195
ON4CAS.....194
NIØC.....193
N4NX.....192
HA1ZH.....190
BA4DW.....188
HB9DDZ.....188
K2AU.....187
K8YTO.....186
WO7R.....185
N3RC.....184
K2SHZ.....182
KJ6P.....180
W6XK.....180
W5ODD.....177
NØFW.....176
WA9PIE.....176
HB9BOS.....175
NKØS.....175

SSB

W1CU.....249
W4ABW.....202
VE7SMP.....201
KØDEQ.....198
W4UM.....198
JN3SAC.....191
WA5VGI.....189
N4MM.....188
W3LL.....187
NØFW.....176
DL3DXX.....175

CW

W1CU.....253
HA5WA.....235
DL6KVA.....233
KØDEQ.....214
JN3SAC.....211
DL3DXX.....210
DL2DXA.....209
W4UM.....200
OK1AOV.....198
WA5VGI.....197
NIØC.....190
HB9DZZ.....186
N4MM.....184
OK2PO.....184
N4NX.....177
N7WO.....175

Digital

W1CU.....195

The WPX Program

CW

3915 . . . . . K1PL
3916. . . . . EI2JD

SSB

4240 . . . . . K1PL
4241 . . . . . XE2NL
4242 . . . . . K6VHF
4243 . . . . . IW9DNI
4244 . . . . . W9ABK
4245. . . . . EI2JD
4246 . . . . . KC3HXF

Mixed

3895 . . . . . K1PL
3896 . . . . . KD7HCW
3897. . . . . EI2JD
3898. . . . . GØGLJ
3899. . . . . K9UO
3900. . . . . KA3D
3901. . . . . N1AH
3902. . . . . AA4UC
3903. . . . . N8USY
3904 . . . . . AC9O
3905 . . . . . IK2RPE
3906. . . . . VK2AAH
3907 . . . . . KC3HXF

Digital

1122 . . . . . K1PL
1123 . . . . . KD3CI
1124. . . . . WW5XX
1125 . . . . . K9UO
1126. . . . . JR7CYR
1127 . . . . . HL2ZN
1128 . . . . . AC9O
1129 . . . . . R3BV
1130 . . . . . IK2RPE

CW: 350: KA3D. **400:** K1PL, N6PM. **650:** EI2JD. **1500:** NIØC. **1650:** JA7FFN. **2850:** HA9PP. **4600:** IZ3ETU. **4700:** I3FIY.

SSB: 350: W9ABK, AA4UC, K6VHF. **450:** N6PM. **500:** MIØGTA. **700:** JH1APK. **1050:** K1PL. **1100:** EI2JD. **1800:** IK2RPE. **2600:** PA2TMS. **2750:** HA9PP. **3400:** I3ZSX.

Mixed: 450: KA3D, KC3HXF. **500:** MIØGTA. **550:** N1AH, W5UJ. **700:** N6ZDH. **750:** N3DF. **850:** KE8Y, K9UO. **950:** N6DBF. **1000:** PY3CJS, DL1BSN. **1150:** K6VHF. **1500:** EI2JD. **1550:** K1PL. **1750:** NIØC, N6PM. **2100:** G4FKA. **2200:** TF5B, JH1APK. **2600:** PA2TMS. **2650:** IK2RPE. **2800:** HB9BIN. **4200:** HA9PP.

Digital: 350: N8USY. **400:** KE8Y, AC9O, DL5KLX. **450:** JR7CYR, HL2ZN. **550:** N1AH. **700:** JF2OHQ, NIØC, N6DBF, N6ZDH. **750:** K1PL, N3DF, R3BV. **800:** AF6O. **850:** K9UO. **900:** K6VHF. **1000:** PY3CJS. **1200:** G4FKA. **1450:** HA9PP. **1500:** JH1APK. **1600:** N6PM. **1650:** IK2RPE. **1700:** HB9BIN. **2150:** TF5B.

160 Meters: UA1OM, EI2JD, KA3D
80 Meters: UA1OM, GØGLJ, K6VHF
40 Meters: UA1OM, K6VHF, K9UO, KD7HCW, HL2ZN, KC3HXF
30 Meters: UA1OM, JF2OHQ, K6VHF
20 Meters: WW5XX, K1PL, UA1OM, K6VHF, DL1BSN, K9UO, N1AH, JR7CYR, R3BV, IK2RPE, KC3HXF
17 Meters: UA1OM, G4FKA
15 Meters: UA1OM
12 Meters: UA1OM
10 Meters: UA1OM, K6VHF

Africa: UA1OM, HB9BIN
Asia: UA1OM, AF6O, EA3EQT, DL1BSN, JR7CYR, HL2ZN, R3BV, VK2AAH
Europe: UA1OM, AF6O, K6VHF, DL1BSN, EI2JD, GØGLJ, K9UO, N1AH, AA4UC, HL2ZN, R3BV, AC9O, KC3HXF
Oceania: UA1OM, K6VHF, TF5B, HL2ZN
North America: KD3CI, UA1OM, XE2NL, AF6O, K6VHF, W9ABK, JF2OHQ, WW5XX, KD7HCW, EI2JD, K9UO, KA3D, N1AH, N8USY, KC3HXF
South America: UA1OM

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage for airmail) to "CQ WPX Awards," P.O. Box 355, New Carlisle, OH 45344 USA. Note: WPX will now accept prefixes/calls which have been confirmed by eQSL.cc. and the ARRL Logbook of The World (LoTW).

*Please Note: The price of the 160, 30, 17, 12, 6, and Digital bars for the Award of Excellence are $6.50 each.

The WAZ Program

SINGLE BAND WAZ

6 Meter

150.....JF8QNF, 25 Zones

12 Meter CW

104.....JF8QNF

15 Meter SSB

680.....JN8QNF

17 Meter CW

125.....JA7OUV
126.....JN8QNF

20 Meter CW

652.....UA1OM

20 Meter SSB

1254.....N6PAT
1255.....JF8QNF

30 Meter CW

157.....W6XK
158.....JF8QNF

30 Meter Digital

6.....JA7OUV

40 Meter CW

324.....JA7OUV
325.....JF8QNF

80 Meter Digital

2.....LA9BM

160 Meter

589.....EA5BRE, 33 Zones
590.....W1NT, 30 Zones
591.....KDØQ, 37 Zones
592.....JA1BK, 40 Zones
593.....JF8QNF, 40 Zones

160 Meter Updates

515.....SP3CGK, 35 Zones
540.....RV3LO, 40 Zones

ALL BAND WAZ

CW

1050.....OZ1IKY
1051.....DF1BN
1052.....W1NT
1053.....JA8QNF
1054.....K2CS

Digital

108.....OZ1IKY
109.....IUØLFQ
110.....JA6GPR
111.....JA4JBT
112.....W2/JR1AQN
113.....JA8QNF

Mixed

9773.....KB3IFH
9774.....IUØLFQ
9775.....DJ7WG
9776.....CT1DNU
9777.....BH7PFH
9778.....KF2T
9779.....JA6GPR
9780.....JA1BK
9781.....HA5NR
9782.....JF8QNF
9783.....IU6AKY
9784.....W2CCC

SSB

5452.....OZ1IKY
5453.....IK2XYI
5454.....IK2HPG
5455.....RUØA
5456.....KDØQ
5457.....JF8QNF

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, John Bergman, KC5LK, 125 Deer Trail, Brandon, MS 39042-9409. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to John Bergman. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. KC5LK may also be reached via e-mail: <kc5lk@cq-amateur-radio.com>.

60 Meters – the "Channel Band," Part 2

Getting Permission for Pitcairn

BY JOE PATER, W8GEX

This is a follow-up to Joe's contribution to this column last month, "DXing on 60 Meters." – N2OO

Ralph Fedor, KØIR, team leader for last fall's Pitcairn VP6R DXpedition (October 18-November 1, 2019), had been turned down by the licensing folks in New Zealand for permission to operate 60 meters. He had his hands full testing equipment and getting the container ready for shipment to New Zealand and, knowing I had helped many teams get on this band in the past, asked if I would help in winning permission.

I knew I would need help on this project, so I asked Paul Gaskell, G4MWO, and Mike McAlevey, ZL4OL, for assistance. Between the three of us, plus Ralph, we sent many, many emails. First, we wrote Shirley Dillon of the Pitcairn administrative office in New Zealand. She referred the request to Bill Haigh, Telecommunications Network Manager for the Government of the Pitcairn Islands, and he again denied the request. Not ready to give up, Paul wrote to Laura Clarke, the Pitcairn Governor, who lives off island as she is also the UK High Commissioner for New Zealand. With his letter he sent supporting documents from the International Telecommunication Union's WRC-15 conference, showing 60 meters had been allocated worldwide for amateur operation. Unsure if the email had been delivered, Mike volunteered to call her, but with no luck. In the meantime, in response to a fax, Paul received a note from the Governor's secretary saying that the Governor was on leave, but she would pass on the letter upon her return. When Paul finally did get a response from the fax, the situation at that point still remained unchanged.

By now, Meralda Warren, VP6MW, who lives on the island, had joined our team. She had been very active from 1984 until recently when she had some equipment failure. Meralda asked Bill for permission and also got a "no" answer. Then she asked the Pitcairn Island Council if they would ask Bill Haigh to reconsider, which led to several meetings on this issue. One reason Bill was turning us down is that he was reading old 60-meter documents and was concerned about interference, so we needed to bring him up to date.

Paul is great on this type of research, so he provided outstanding information for his review.

In the meantime, Mike had asked John Moriarty, ZL2JPM, of NZART (New Zealand's national amateur radio society) and the IARU liaison officer in New Zealand, for help. John knew that the ITU WRC-15 60-meter frequencies were 300-kHz away from the New Zealand Search & Rescue frequency, and interference shouldn't be a problem, so he contacted Bill and explained the frequency range and the new ITU 60-meter frequency allocation. Shortly after this, our permission was finally granted (with the condition that we maintain an open sat-phone circuit with New Zealand authorities whenever we were on the band, and that we would shut down immediately if any interference to primary users was reported).

This is the 60-meter vertical used at VP6R to make nearly 1,000 FT8 QSOs on the band. Getting permission to operate on 5 MHz was a major effort! (Photo courtesy of the VP6R team)

Confusing to say the least, but as you can tell, this team of KØIR, ZL4OL, G4MWO, VP6MW, ZL2JPM, and W8GEX worked tirelessly for several months in obtaining this permission. At times we were about to give up, but we persevered. Paul and I have worked on other licensing projects and Mike, being a local down-under, was so helpful because he knew the right people to contact. It was my privilege to work with such an outstanding crew and for the team of VP6R.

Our most sincere gratitude goes to Bill Haigh, ZL1BUQ, the Telecommunications Network Manager for the Government of the Pitcairn Islands, for his reconsideration of this permit.

The team finished the operation with more than 82,000 total QSOs, of which 993 were on 60 meters — all on FT8 and each one an ATNO (all-time new one) for the band.

The WPX Honor Roll

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with the CQ Master Prefix list. Scores are based on the current prefix total, regardless of an operator's all-time count. Honor Roll must be updated annually by addition to, or confirmation of, present total. If no up-date, files will be made inactive.

MIXED

8893 .....9A2AA
7892 .....K2VV
7543 .....W1CU
7414 .....9A2NA
6589 .....EA2IA
6261 .....KF2O
5589 .....N4NO
5582 .....ON4CAS
5483 .....S53EO
5428 .....W9OP
5360 .....KØDEQ
5291 .....YU1AB
5270 .....VE1YX
5260 .....I5RFD
5209 .....N6JV
5165 .....N8BJQ

4837 .....WA5VGI
4757 .....I2MQP
4681 .....JH8BOE
4583 .....W9OO
4574 .....JN3SAC
4561 .....NN1N
4521 .....IK2ILH
4462 .....K1BV
4342 .....WB2YQH
4298 .....VE3XN
4201 .....YO9HP
3880 .....W3LL
3821 .....N6QQ
3764 .....K9UQN
3739 .....WD9DZV
3611 .....W2OO

3539 .....AB1J
3538 .....9A4W
3459 .....W9IL
3099 .....N6FX
3073 .....IK2DZN
2975 .....SV1EDY
2968 .....AB1OC
2866 .....AG4W
2850 .....NXØI
2834 .....N3RC
2729 .....W6XK
2697 .....AK7O
2589 .....DG7RO
2583 .....PA2TMS
2550 .....K6ND
2457 .....K5UR

2394 .....AE5B
2368 .....HK3W
2340 .....NE6I
2318 .....AA8R
2293 .....WA6KHK
2225 .....JH1APK
2203 .....KI1U
2200 .....N7ZO
2176 .....V51YJ
2133 .....KØKG
2109 .....W2FKF
2040 .....K4HB
2016 .....N2WK
1934 .....NKØS
1930 .....K3CWF
1888 .....VA7CRZ

1828 .....K7LV
1824 .....WF7T
1821 .....PY5FB
1813 .....IZØFUW
1798 .....N6PM
1784 .....JR3UIC
1771 .....NIØC
1746 .....K6UXO
1718 .....N5KAE
1711 .....NS3L
1667 .....AD3Y
1652 .....N6PEQ
1647 .....9A2GA
1643 .....SV1DPI
1616 .....TA1L
1570 .....PY5VC

1568 .....N3AIU
1524 .....NH6T/W4
1484 .....FG4NO
1480 .....K4JKB
1462 .....AC7JM
1462 .....DL4CW
1447 .....K3XA
1422 .....I2VGW
1408 .....NH6T
1398 .....ES4RLH
1361 .....VA3VF
1341 .....W1FNB
1322 .....AA4FU
1301 .....JF1LMB
1301 .....KB9OWD
1301 .....K1DX

1301 .....KM5VI
1295 .....NIØC
1280 .....WF1H
1260 .....UR6LEY
1219 .....K6HRT
1217 .....AB1QB
1201 .....K9BO
1193 .....KC1UX
1167 .....WA9PIE
1153 .....N3CAL
1148 .....SP8HKT
1137 .....YO5BRZ
1136 .....KO9V
1116 .....YU7FW
1107 .....PY2MC
1100 .....WA3GOS

1074 .....WU9D
1071 .....N6MM
1069 .....IZ4MJP
1032 .....DG5LAC
1023 .....N4WQH
1016 .....W9QL
1012 .....NØVVV
1010 .....VE3RZ
1007 .....AA4QE
1006 .....NØRQV
948 .....W6WF
919 .....ON7MIC
889 .....WU1U
857 .....R1AV
835 .....K6RAH
780 .....N3DF

766 .....WB6IZG
762 .....JP1KHY
758 .....N4JJS
757 .....WB3D
736 .....JA3MAT
718 .....KE4PLT
711 .....AG1T
682 .....AI8P
680 .....JA6JYM
661 .....AL4Y
633 .....TI5LUA
621 .....K4HDW
616 .....AC6BW
605 .....IW2FLB
600 .....WA3QWA

SSB

6673 .....OZ5EV
5955 .....9A2NA
5989 .....K2VV
5155 .....VE1YX
4988 .....KF2O
4800 .....EA2IA
4410 .....I2MQP
3927 .....KØDEQ
3681 .....N4NO
3613 .....SV3AQR
3433 .....NN1N
3403 .....I8KCI
3383 .....W9OO
3344 .....W3LL
3333 .....CT1AHU
3274 .....YU7BCD

3174 .....I3ZSX
3172 .....YO9HP
3108 .....I4CSP
3101 .....WA5VGI
3071 .....N8BJQ
3062 .....DL8AAV
2990 .....KF7RU
2984 .....KI7AO
2936 .....N6QQ
2903 .....IN3QCI
2862 .....PT7ZT
2857 .....4X6DK
2650 .....IK2DZN
2623 .....W2OO
2595 .....EA1JG
2582 .....PA2TMS

2568 .....SM6DHU
2532 .....W9IL
2451 .....EA3GHZ
2443 .....JN3SAC
2362 .....AG4W
2335 .....KG1E
2326 .....CX6BZ
2209 .....IK2QPR
2201 .....NQ3A
2200 .....N6FX
2198 .....AB1OC
2122 .....AE5B
2109 .....W2FKF
2105 .....K9UQN
2094 .....I8LEL
2093 .....W2WC

2088 .....N3RC
2084 .....K5UR
2076 .....K2XF
2048 .....NXØI
2048 .....W4QNW
1955 .....EA3NP
1935 .....SV1EOS
1879 .....K3IXD
1874 .....WD9DZV
1848 .....AB5C
1825 .....KQ8D
1812 .....K6ND
1789 .....WA6KHK
1646 .....VE7SMP
1641 .....AE9DX
1622 .....K5CX

1611 .....W2ME
1587 .....N3XX
1550 .....IK2RPE
1442 .....DG7RO
1386 .....IK4HPU
1383 .....NKØS
1371 .....VE6BF
1357 .....HK3W
1338 .....NE6I
1334 .....EA3EQT
1312 .....N5KAE
1262 .....K7LV
1258 .....N1KC
1222 .....YF1AR
1209 .....N6PEQ
1187 .....IZ1JLG

1183 .....KI1U
1150 .....VE6BMX
1146 .....SQ7B
1124 .....K3CWF
1112 .....NH6T
1098 .....K4CN
1096 .....JA7HYS
1089 .....IZ8FFA
1089 .....IT9ABN
1053 .....N6MM
1042 .....IZØBNR
1032 .....DG5LAC
1031 .....K4CN
1031 .....IK8OZP
1022 .....NW3H
1012 .....KU4BP

1004 .....K4HB
1004 .....WA5UA
998 .....W6XK
978 .....EA7HY
957 .....W9QL
934 .....PY5VC
931 .....YB1AR
929 .....NS3L
919 .....KA5EYH
893 .....W9RPM
889 .....N3AIU
875 .....K7SAM
854 .....K6HRT
833 .....DK8MCT
808 .....UR6LEY
802 .....N6OU

801 .....K3XA
766 .....I2VGW
763 .....K4JKB
758 .....IV3GOW
724 .....WF1H
724 .....W3TZ
717 .....KØDAN
717 .....N3JON
714 .....YB2TJV
713 .....JH1APK
710 .....WA9PIE
700 .....N4FNB
700 .....JA1PLL
694 .....KG4HUF
690 .....W6PN
684 .....KO9V

675 .....F1MQJ
655 .....VA3VF
647 .....YB8NT
640 .....UA9YF
637 .....K5WAF
630 .....W6US
624 .....K6KZM
606 .....KJ4BIX
604 .....GØBPK
600 .....WU1U
600 .....WA3PZO

CW

7185 .....WA2HZR
6956 .....K2VV
5634 .....9A2NA
5160 .....N4NO
5104 .....EA2IA
5092 .....N6JV
5004 .....KF2O
4726 .....W8IQ
4570 .....I3FIY
4470 .....N8BJQ
4469 .....IZ3ETU

4429 .....KØDEQ
4132 .....WA5VGI
4046 .....I7PXV
3974 .....JN3SAC
3584 .....NN1N
3523 .....W9OO
3504 .....YU7BCD
3318 .....K9UQN
3279 .....IØNNY
3214 .....SM6DHU
3041 .....YO9HP

2948 .....IK3GER
2915 .....KA7T
2811 .....OZ5UR
2806 .....WD9DZV
2685 .....W2OO
2667 .....W9IL
2615 .....N6QQ
2531 .....I2MQP
2490 .....N6FX
2477 .....VE6BF
2424 .....W2WC

2357 .....W9HR
2295 .....EA7AAW
2291 .....N3XX
2278 .....W3LL
2212 .....AC5K
2040 .....NXØI
2022 .....AF5CC
1998 .....K5UR
1880 .....N3RC
1832 .....N4YB
1772 .....WA6KHK

1762 .....K6ND
1744 .....NE6I
1727 .....K6UXO
1691 .....KI1U
1620 .....DG7RO
1595 .....PY5FB
1505 .....R3IS
1487 .....NIØC
1480 .....WO3Z
1443 .....WA2VQV
1415 .....W6XK

1389 .....IT9ELD
1362 .....KN1CBR
1348 .....VE1YX
1342 .....VE6BMX
1295 .....AG4W
1235 .....JH1APK
1220 .....AA4FU
1210 .....DL4CW
1196 .....N3AIU
1098 .....LU5OM
1062 .....K3XA

1027 .....AE5B
992 .....F5PBL
962 .....K7LV
944 .....AB1OC
935 .....K3CWF
908 .....NH6T
903 .....N6PEQ
891 .....DK8MCT
890 .....NS3L
889 .....N3AIU
864 .....YO5BRZ

848 .....PY5VC
842 .....HK3W
821 .....HB9DAX
783 .....YB1AR
752 .....K6HRT
743 .....JA5NSR
738 .....NH6T/W4
732 .....SQ7B
722 .....WA9PIE
720 .....K4CN
711 .....JF1LMB

692 .....N5KAE
652 .....IK2DZN
629 .....IV3GOW
620 .....AF5DM
615 .....JH6JMM
608 .....W9RPM
605 .....NKØS
600 .....NY4G
600 .....IK2SGV

DIGITAL

2692 .....N8BJQ
2636 .....W3LL
2558 .....NT2A
2360 .....KF2O
2345 .....N6QQ
2217 .....YO9HP
2208 .....W6XK
2140 .....WD9DZV

1889 .....HK3W
1790 .....JN3SAC
1759 .....WA5VGI
1756 .....KØDEQ
1734 .....AG4W
1704 .....IK2DZN
1628 .....N6PM
1565 .....N7ZO

1500 .....JH1APK
1456 .....N3RC
1426 .....AB1OC
1340 .....NXØI
1335 .....K3CWF
1325 .....W2OO
1250W2/JR1AQN
1227 .....ES4RLH

1200 .....K2YYY
1149 .....W9IL
1129 .....NKØS
1112 .....AB1QB
1093 .....KI1U
1091 .....VA3VF
1089 .....AC7JM
1086 .....KC1UX

1051 .....KH6SAT
1047 .....RW4WZ
1021 .....NN1N
1009 .....GUØSUP
1002 .....NØRQV
971 .....JF1LMB
966 .....NS3L
947 .....I2VGW

922 .....EA2IA
917 .....K7LV
901 .....W1FNB
898 .....K9UQN
866 .....SQ7B
858 .....WU9D
855 .....R1AV
830 .....NE6I

812 .....UR6LEY
811 .....WF1H
810 .....N3CAL
800 .....WA3GOS
783 .....YB1AR
772 .....N3DF
758 .....N4JJS
750 .....ON7MIC

750 .....NH6T/W4
681 .....PY5VC
672 .....K9AAN
670 .....IV3GOW
668 .....KA5EYH
661 .....AF4T
660 .....JP1KHY
654 .....WB6IZG

654 .....JA3MAT
640 .....WA9ONY
636 .....W9RPM
611 .....KO9V
600 .....N1RR
600 .....ADØFL

REMOTE OPERATION

CW	MIXED	SSB	DIGITAL
7277 .....K9QVB	4026 .....N1RR	2953 .....N1RR	671 .....N1RR
3292 .....N1RR			

1960s through the early 1990s are being image scanned by my SJDXA crew and the files will be triple backed up for future reference. Once this is completed, I plan to do the same with all of the other paper logs that I am holding.

There very well could be more resources available out there. But these are the ones that I use.

So, don't give up on that OLD QSL. The oldest QSL that I have processed here as a QSL manager goes back to the 1960s. That put a smile on someone's face for sure! *– 73 de N2OO*

CQ DX Awards Program

Endorsements – CW

W6YQ 319

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio.com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Please make checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA. We recognize 341 active countries. Please make all checks payable to the award manager. Photocopies of documentation issued by recognized national Amateur Radio associations that sponsor international awards may be acceptable for CQ DX award credit in lieu of having QSL cards checked. Documentation must list (itemize) countries that have been credited to an applicant. Screen printouts from eQSL.cc that list countries confirmed through their system are also acceptable. Screen printouts listing countries credited to an applicant through an electronic logging system offered by a national Amateur Radio organization also may be acceptable. Contact the CQ DX Award Manager for specific details.

The CQ DX Field Award Program

New Awards – Mixed

W1CU 195

Endorsements – CW

NKØS .....3.5/7 MHz

Endorsements – Mixed

W6KX.....180 NKØS.....175
K8OOK 225

Endorsements – SSB

NKØS.....152

Endorsements – Digital

NKØS...28 & 3.5/7 MHz

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio. com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA. Please make all checks payable to the award manager.

5 Band WAZ

As of November 15, 2019
2164 stations have attained at least the 150 Zone level, and
1022 stations have attained the 200 Zone level.

As of November 15, 2019
The top contenders for 5 Band WAZ (Zones needed on 80 or other if indicated):
CHANGES shown in **BOLD**

Callsign	Zones	Zones Needed	Callsign	Zones	Zones Needed
AK8A	199	17	W1FJ	199	24
DM5EE	199	1	W1FZ	199	26
EA3GP	199	19 on 10M	W2LK	199	23
EA5RM	199	1	W3NO	199	26
EA7GF	199	1	W4LI	199	26
H44MS	199	34	W4UM	199	23
HAØHW	199	1	W6DN	199	17
HA5AGS	199	1	W6RKC	199	21
I5REA	199	31	W9XY	199	22
IKØXBX	199	19 on 10M	WAØMHJ	199	23
IK1AOD	199	1	WA2BCK	199	23
IK8BQE	199	31	9A5I	198	1, 16
IZ3ZNR	199	1	EA5BCX	198	27, 39
JA1CMD	199	2	F5NBU	198	19, 31
JA5IU	199	2	G3KDG	198	1, 12
JA7XBG	199	2	G3KMQ	198	1, 27
JH7CFX	199	2	HB9FMN	198	1 on 80 & 10
JK1BSM	199	2	JA1DM	198	2, 40
K1LI	199	24	JA3GN	198	2 on 80 & 40
K2RD	199	18	JA7MSQ	198	2 on 80 & 10
K4HB	199	26	JH1EEB	198	2, 33
K5FUV	199	23	K2EP	198	23, 24
K5TR	199	22	K2TK	198	23, 24
K7UR	199	34	K3JGJ	198	24, 26
K9KU	199	22 on 15	K3LR	198	22, 23
KBØEO	199	23	K3PA	198	18,23
KZ4V	199	26	K4JLD	198	18, 24
N3UN	199	18	K5OT	198	18, 23
N4NX	199	26	KZ2I	198	24, 26
N4WW	199	26	LU2DX	198	23, 29
N4XR	199	27	N2QT	198	23, 24
N8AA	199	23	N4GG	198	18, 24
RA6AX	199	6 on 10M	N8TR	198	18, 23 on 10
RU3DX	199	6	UA4LY	198	6 & 2 on 10
RWØLT	199	2 on 40M	UN5J	198	2, 7
RX4HZ	199	13	US7MM	198	2, 6
RZ3EC	199	1 on 40M	W5CWQ	198	17, 18
S58Q	199	31	W6TMD	198	34,40
SM7BIP	199	31	W9RN	198	26, 19 on 40
SP3RBG	199	2 on 10M	WC5N	198	22, 26
VE2TZT	199	23	WL7E	198	34, 37
VO1FB	199	19	ZL2AL	198	36, 37

The following have qualified for the basic 5 Band WAZ Award:

Callsign	5BWAZ #	Date	# Zones
JH1FSB	2161	2019-10-18	180
RUØA	2162	2019-11-01	178
KDØQ	2163	2019-11-02	189
K4EM	2164	2019-11-08	160

Updates to the 5BWAZ list of stations:

Callsign	5BWAZ #	Date	# Zones
None			

New recipients of 5 Band WAZ with all 200 Zones confirmed:

5BWAZ #	Callsign	Date	All 200 #
None			

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, John Bergman, KC5LK, 125 Deer Trail, Brandon, MS 39042-9409. The processing fee for the 5BWAZ award is $10.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $15.00 for nonsubscribers. An endorsement fee of $2.00 for subscribers and $5.00 for nonsubscribers is charged for each additional 10 zones confirmed. Please make all checks payable to John Bergman. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. KC5LK may also be reached via e-mail: <kc5lk@cq-amateur-radio.com>.

***Please note: Cost of the 5 Band WAZ Plaque is $100 shipped within the U.S.; $120 all foreign (sent airmail).**

AWARDS

BY EDDIE DEYOUNG,* KS4AA

Helpful Tips to Earn Your Award QSOs

USA-CA Award Update

500 County Level

AE4WG – Award Number 3776 dated October 20th, 2019

1,000 County Level

AE4WG – Award Number 1918 dated October 20th, 2019
W1FNB – Award Number 1919 dated October 24th, 2019

Happy New Year! May all your award dreams come true this year, and, a big "happy 75th anniversary" to *CQ* magazine. This month we focus on getting those award QSOs, then next month on getting confirmations as quickly and cheaply as possible. Many of us have been chasing award QSOs for years or decades. But, even "old dogs" can learn new tricks. Newcomers to award-chasing should pick up some good tips. Plus, we will mention some things *not* to do. In no particular order, the following list was formed over the years by trial and error as well as through great advice from some "big guns." Starting with the actions you *should* do:

The 3 P's: Patience, persistence, and perseverance. These are self-explanatory. Never, never, lose your temper or be rude on the air, or in social media or DX Summit comments.

The 3 L's: Listen, listen, and listen. If the station you want to work is announcing it is listening for Europe, then wait until the operator announces general calls (unless, of course, you're in Europe!). Sometimes, a band is open to a specific area for only a short period, so just be patient. If the station is calling for fours and your call is not a four, then wait until he/she gets to your number. And the "cardinal rule" is never, repeat never ever, call a DXpedition on its transmit frequency unless it is "quiet" and you hear the operator working others simplex. While waiting, check the VOACAP prediction.

VOACAP Predictions: The easiest way I have found to find the path and propagation prediction for a specific location is to go to "DX Summit" <http://www.dxsummit.fi >. When you see a station you want to work listed, just click on it. You will be offered several choices. Select "Show VOACAP Predictions." You will then get a circular chart showing the 80- to 10-meter bands over 24 hours and different colored sections (see example in Figure 1). These colors indicate your chance of best propagation as well as the beam heading. You can also select short or long path and basic or super station. Another source to find out if your transmit signal is propagating to the desired area is by using the Reverse Beacon Network <http://www.reversebeacon.net>. Finally, listen for the worldwide beacon network set up by the Northern California DX Foundation (NCDXF) to know if you can hear signals from selected areas and on what bands. A guide to the NCDXF beacons may be found at <http://www.ncdxf.org/beacon/>.

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SSB Phonetics: Try to use international phonetics (see Table 1). If working a DX station who speaks a different language than you do, you might also try phonetics in the DXer's language. These other phonetics are available by doing an online search.

Split Operation: Listen above or below the DX station's frequency for other stations that are getting through. Put your

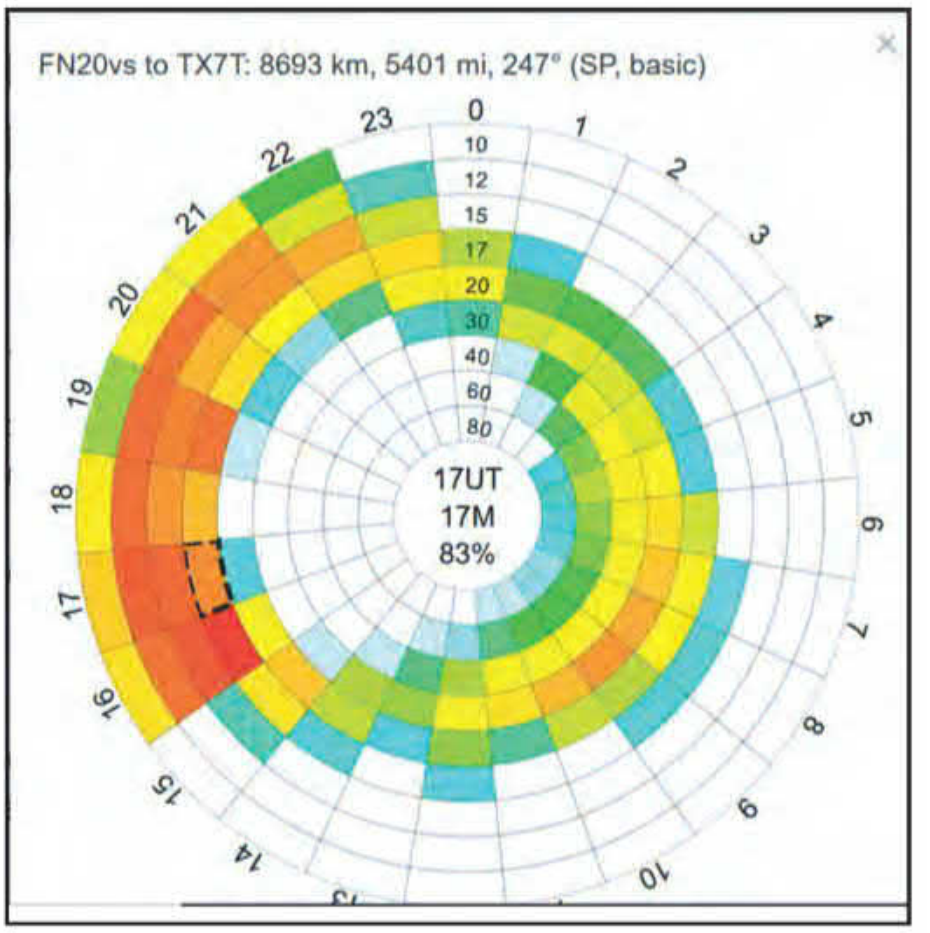

Figure 1. A VOACAP prediction chart on DX Summit. This particular chart shows the chances of working TX7T in the Marquesas Islands from New Jersey at various times and on various bands. (Screen capture from www.dxsummit.fi)

Table 1. ICAO Phonetic Alphabet

A - Alfa	J - Juliett	S - Sierra
B - Bravo	K - Kilo	T - Tango
C - Charlie	L - Lima	U - Uniform
D - Delta	M - Mike	V - Victor
E - Echo	N - November	W - Whiskey
F - Foxtrot	O - Oscar	X - X-ray
G - Golf	P - Papa	Y - Yankee
H - Hotel	Q - Quebec	Z - Zulu
I - India	R - Romeo	

Table 1. The ICAO (International Civil Aviation Organization) phonetic alphabet is the generally-accepted worldwide standard for phonetics over the radio. It is better to use these than to try "cute" alternatives, especially for stations whose first language is something other than English. (Source: <www.icao.int>)

transmit signal on or near that frequency, then call in split-mode. Check the frequency every few minutes to see if the DX station is moving up, down, or keeping its receiver frequency constant. For example, if the station is using SSB and says "up," then tune your VFO-B (if you have one) about 5 kHz higher than their transmit frequency to start with. If you can hear the calling stations, put VFO-B on or near that frequency. Again, listen, listen, listen, to determine the listening pattern of your target station. This will give you the best chance of being heard amongst the pileups. The same applies to CW and RTTY/PSK.

FT4, FT8 Modes: These require a different approach. First, determine if the station you want is working other stations in common mode or using the fox-hound mode. If common mode, then keep a careful watch on the spectrum display and choose a clear spot. Some stations will call directly on the other station's transmit frequency, but this does not always work as a lot of newbies do this. You will have a better chance to work the station by finding a clear frequency. It does not matter what your transmit frequency is as the modes will display all signals within their spectrum bandwidth. If the station you want to work is using the fox-hound (F/H) mode, then you simply call once at least 1 kHz above its transmit frequency. The mode will assign your transmit frequency. When worked, you will get a bulk message of confirmation.

Here's What NOT To Do

• Never tune your transmitter or antenna on the other station's frequency. I cannot stress this enough!

• Do not call a station if the operator says he/she is listening for specific areas or transmits other instructions that have no relationship to your call or location. Again, **I cannot stress this enough**, it's a fast way to infuriate the station you are trying to reach and earn you a first-class ticket to the doghouse.

• Watch your transmit audio level. Check the ALC and/or compression levels when doing your setup. Excessive ALC or compression simply causes your audio to become more and more distorted as well as increasing your transmit bandwidth. This reduces your chances of getting that QSO as well as annoying a lot of others. A few dB of ALC and a mid-or-less compression level are all that are needed for producing good quality audio. The worst things you can do if you get frustrated over not being heard are to increase the mic gain, shout into the mic, or turn up your compression level. Trust me, it only makes your signal more and more distorted. In other words, it will have the opposite affect to what you want.

• If the station is trying to work as many others as possible in the shortest time possible, then please do not start a rag-chew once your call is acknowledged. Just reply with "QSL 59" or send QSL 599 on CW. Repeat your call phonetically or slower on CW several times if you do not think they got it correctly. That's it, nothing more.

• Then there is my pet peeve on SSB. Saying, "Over over!" ☺

OK, let's keep those award managers busy with your applications and endorsements.

– Eddie, KS4AA

CONTESTING

BY DAVID SIDDALL,* K3ZJ

Contesting Comes Alive in the Winter Cold

This month's highlights:

- Nominations are open for the CQ Contest Hall of Fame
- New claimed QSO records set during the 2019 CQWW CW weekend
- Inside scoop on contest adjudication
- CQWW 160-Meter Contest
- Mini-contest at QuartzFest.

This month, the ARRL RTTY Roundup marks the traditional opening of the winter contest season over the weekend of January 4 and 5, 2020. As noted in last month's column, this competition allows all of the digital modes, including FT4 and FT8. Using one of the WSJT-X modes automatically places the entry into the "unlimited" category because multiple signals are simultaneously decoded. Although FT4 and FT8 are wildly popular throughout the year, experienced contesters have found that significantly more QSOs per hour can be completed using traditional RTTY. This is true even with the faster FT4. Enjoy the weekend whether you choose traditional RTTY, FT4, or mix the two.

VHF contesters also are likely to be using WSJT-X modes in the ARRL VHF Contest over the weekend of January 18-20. The WSJT-X modes, including MSK144, are more popular during VHF contests than during HF contests, and we expect the same pattern to continue this year. Quite often, the "JT" in "WSJT" — Joe Taylor, K1JT — shows up during the contest to work stations so keep an eye out for Joe.

CQ's own CQWW 160-Meter Contest will round out the month with a bang on January 24-26. Sunspots are expected to be at the lowest point we are likely to experience for at least the next decade, so topband enthusiasts are making every effort this year to clear their calendars and fire up their rigs. Because of the unmatched DX turnout for this contest, DXCC and WAZ seekers also should show up to see if they can add to their totals. This is the year to do it! Although a low sunspot number alone does not equate to outstanding propagation, the chances are better than average that some rare DX will make it through on the topband.

Please note that nominations are open for the CQ Contest Hall of Fame and consider nominating someone deserving. Details are below.

The CQWW CW weekend concluded as we are writing this month's column, and I had to refresh my browser to make sure that I was not seeing double. Two single-operator all-band (SOAB) entries claim record-breaking QSO totals in excess of 10,000 during the 48-hour event. WOW! That's all I can say. Congratulations to KL9A and N6MJ, each of whom broke the 10K barrier based on their claimed scores. But notwithstanding the high QSO totals, CT1BOH at powerhouse D4C broke 20 million points with the highest claimed score, reflecting more 3-point QSOs. Another outstanding accomplishment. These scores at sunspot minimum do make me wonder what kind of records will be set when the return of sunspots allows 10 and 15 meters to sustain day-long pileups.

Ever wonder how contest logs are reviewed? The RSGB adjudicator, MØBOX, was interviewed on this subject and you can view her discussion at the link provided below.

The ARRL has established fora in which ARRL members can discuss contest topics and ask questions. The ARRL contest staff and some of the Contest Advisory Committee members participate so there can be genuine dialogue and authoritative answers in relatively quick fashion. Check it out at the link below.

Finally, getting new blood into contesting is a constant topic of discussion. One idea is to create a short contest appropriate at a club meeting or during a ham gathering. One such event will be held at the annual QuartzFest ham event in late January. Their activity might provide some ideas for others. And look for signals from the week-long gathering out in Arizona desert.

email: <k3zj@cq-amateur-radio.com>

CQ 160-Meter CW Contest

It's that time of year again to concentrate one's operating on the low bands, and especially on 160 meters. This year's contest will open on January 24 at 2200 UTC and continue until January 26 at 2200 UTC. What better way to keep warm during the cold nights than to fire up that 160 meter amplifier? Well, unless you have invested in one of the solid-state amplifiers. In that case, just turn up the heat.

Low sunspot counts do not guarantee great conditions, but the chances for excellent conditions are much greater than during mid-to-high sunspot years. Complete contest rules, past results, records, and related information are all available online at <https://cq160.com>.

CQ Contest Hall of Fame Nominations Open

The period for submitting nominations for the CQ Contest Hall of Fame is now open. Individuals and clubs must submit nominations in time to be received by March 1, 2020. The nomination should clearly indicate that it is for the Contest Hall of Fame and detail the reasons and basis for the nomination taking into account its purpose as described below.

The CQ Contest Hall of Fame was established in 1986 to recognize amateur radio competitors who have made major contributions to contesting "above and beyond the call of duty." Successful candidates have been those who have given back to the contesting community beyond, or even without, a winning track record.

Note that nominations are *not* held over from year to year. If you made an unsuccessful nomination for 2019 or before, you must resubmit the nomination for it to be considered for 2020. Please update any information and add anything that you think would help to make the case for your nominee.

Usually a limit of two contesters are inducted each year. The induction ceremony traditionally is held at the annual Saturday evening Contest Dinner at the Dayton Hamvention®. This year the dinner will be on May 16, 2020, at the Crowne Plaza Hotel in downtown Dayton, Ohio. Details of the dinner will be posted at <www.contestdinner.com>.

Last year was a rare one in which three recipients were elected. The honorees were Bruce Horn, WA7BNM; Dean Straw, N6BV; and Kresimir Kovarik, 9A5K. Pictures and a description of their accomplishments are in this column in the August 2019 issue of *CQ* at pages 95-96. Past Contest Hall of Fame recipients are listed at <https://tinyurl.com/r6hyujz>.

Nominations may be made by individual contesters, contesting clubs, and national amateur organizations. A nomination must be received by March 1, 2020, to be considered. The mail address is: CQ Contest Hall of Fame, c/o CQ Magazine, 17 W. John St., Hicksville, NY 11801 U.S.A. Or, the preferred method is to submit the nomination directly to CQ by email to <W2VU@cq-

amateur-radio.com>. Be sure to make the subject line “Contest Hall of Fame.” More information is at <http://bit.ly/2jarYtk>.

New Claimed QSO Records During the 2019 CQWW CW Weekend

There were some breakthrough performances in the CQ World Wide CW contest this year, particularly in the single-operator / all-band (SOAB) category. The results that are scheduled to be published in the upcoming May issue of *CQ* will be especially worth reading.

I noted with particular interest in the after-contest reports that two operators appear poised to break the all-time high hourly CW QSO rate of 387, which was set in 2016 by N6MJ. This year Dan appears to have hit 390/hour (before log-checking) from ZF1A.

Calendar of Events

All year (Starts Jan. 1)	**CQ DX Marathon**	**http://bit.ly/vEKMWD**
Dec. 31-Jan. 1	Bogor Old and New Contest	https://contest.orari-bogor.org
Jan. 1	AGB New Year Snowball Contest	http://ev5agb.com/contest/contests_e.htm
Jan. 1	QRP ARCI New Year’s Day Sprint	www.qrparci.org/contests
Jan. 1	SARTG New Year RTTY Contest	www.sartg.com
Jan. 1	AGCW Happy New Year Contest	http://bit.ly/1v6x2N1
Jan. 1	AGCW VHF/UHF Contest	http://bit.ly/1lFdRW0
Jan. 1	UKEICC 80 Meter Contest SSB	http://bit.ly/2MbaURB
Jan. 4	ARRL Kids Day	www.arrl.org/kids-day
Jan. 4	PODSX PSKFest	http://bit.ly/2Qv3wkA
Jan. 4-5	ARRL RTTY Roundup	www.arrl.org/rtty-roundup
Jan. 4-5	EUCW 160m Contest	www.eucw.org/eu160.html
Jan. 4-5	WW PMC Contest	http://bit.ly/2y2QWCc
Jan. 5	Veron SWL New Year Contest	http://bit.ly/2L9eT1L
Jan. 8-9	AWA Linc Cundall Memorial Contest	http://bit.ly/1DEIKTK
Jan. 11-12	AWA Linc Cundall Memorial Contest	http://bit.ly/1DEIKTK
Jan. 11-12	YB DX Contest SSB	http://ybdxcontest.com/dx-station-rules
Jan. 11-12	North American CW QSO Party	http://ncjweb.com/naqp
Jan. 11-12	UBA PSK63 Prefix Contest	http://bit.ly/2Oi8fsa
Jan. 12	DARC 10-Meter Contest	http://bit.ly/2pCiRo1
Jan. 12	NRAU – Baltic SSB Contest	www.nrau.net/nrau-baltic-contest/rules.html
Jan. 12	NRAU – Baltic CW Contest	www.nrau.net/nrau-baltic-contest/rules.html
Jan. 17	LZ Open 80/40 Contest	www.lzopen.com/index.htm
Jan. 18-20	ARRL January VHF Contest	www.arrl.org/january-vhf
Jan. 18-19	Hungarian DX Contest	www.ha-dx.com/en/contest-rules
Jan. 18-19	North American SSB QSO Party	http://ncjweb.com/naqp/
Jan. 24-26	**CQWW 160M CW Contest**	**http://cq160.com/rules.htm**
Jan. 25-26	BARTG RTTY Sprint	http://bartg.org.uk/wp/contests
Jan. 25-26	REF CW Contest	http://concours.ref-union.org/contest/?page_id=2
Jan. 25-26	UBA SSB Contest	http://bit.ly/W0gZiE
Jan. 25-26	Veron SLP Contest	http://bit.ly/2L9eT1L
Jan. 25-26	Winter Field Day	www.winterfieldday.com/rules
Jan. 29	UKEICC 80M Contest CW	http://bit.ly/2MbaURB
Feb. 1	FISTS Winter Slow Speed Sprint	www.fistsna.org/operating.html
Feb. 1	FYBO Winter QRP Sprint	www.qrpcontest.com
Feb. 1	AGCW Straight Key Party	http://bit.ly/1T5SC05
Feb. 1	Minnesota QSO Party	www.w0aa.org/index.php/rules
Feb. 1-2	10-10 Int’l Winter Contest	http://bit.ly/1FrFeBc
Feb. 1-2	Black Sea Cup Int’l	http://bit.ly/10qIpGu
Feb. 1-2	British Columbia QSO Party	www.orcadxcc.org/bcqp_rules.html
Feb. 1-2	Vermont QSO Party	www.ranv.org/ranv.html
Feb. 2	North American CW Sprint	http://ncjweb.com/north-american-sprint
Feb. 5	UKEICC 80m Contests SSB	http://bit.ly/2MbaURB
Feb. 8	RSGB 1st 1.8 MHZ Contest CW	www.rsgbcc.org/hf
Feb. 8	Asia-Pacific Spring Sprint (CW)	http://jsfc.org/apsprint
Feb. 8	FISTS Winter Unlimited Sprint	www.fistsna.org/operating.html
Feb. 8-9	**CQWW RTTY WPX Contest**	**www.cqwpxrtty.com**
Feb. 8-9	Dutch PACC Contest	http://pacc.veron.nl
Feb. 8-9	KCJ Topband Contest	www.kcj-cw.com/e_index.htm
Feb. 8-9	OMISS QSO Party	www.omiss.net/Facelift/qsoparty.php
Feb. 8-9	SARL Field Day Contest	http://bit.ly/H0IqQf
Feb. 8-10	YL OM Contest	https://ylrl.org/wp/yl-om-contest
Feb. 9	CQC Winter QSO Party	http://bit.ly/2Qayte1
Feb. 9-12	Classic Exchange, Phone	www.classicexchange.org
Feb.10-14	ARRL School Club Roundup	www.arrl.org/school-club-roundup
Feb. 12-15	Classic Exchange, CW	www.classicexchange.org
Feb. 14	PODSX Valentine Sprint	http://bit.ly/2Rp8LTk
Feb. 15-16	AWA Amplitude Modulation QSO Party	http://bit.ly/1DEIKTK
Feb. 15-16	ARRL CW DX Contest	www.arrl.org/arrl-dx
Feb. 15-16	Russian WW PSK Contest	http://bit.ly/2MsppCr
Feb. 19	AGCW Semi-Automatic Key Evening	http://bit.ly/1OmoGv8
Feb. 21-23	**CQWW 160M SSB Contest**	**www.cq160.com/rules.htm**
Feb.22-23	REF SSB Contest	http://concours.ref-union.org/contest/?page_id=2
Feb. 22-23	UK/EI DX Contest, CW	www.ukeicc.com/dx-contest-rules.php
Feb. 22-23	Hiroshima Worked All Squares	www.hs-contest.org
Feb. 23	High Speed Club CW Contest	www.highspeedclub.org
Feb. 26	UKEICC 80m Contests CW	http://bit.ly/2MbaURB
Feb. 29	South Carolina QSO Party	http://scqso.com/rules
Feb. 29- Mar. 1	North American RTTY QSO Party	http://ncjweb.com/naqp
Feb. 29-Mar. 1	UBA CW DX Contest	http://bit.ly/W0gZiE

Two winners of the inaugural QuartzFest Most Distant QSO Contest, held in 2019: NK9G (left) won the QRP award, and KØVK (right, with the tallest hat) won the CW award. See text for details.

But Chris, KL9A — Dan's WRTC competition mate — operated at TI7W and reported achieving a 391/hour. Both figures are calculated using the same method and program, so we'll have to wait and see how this comes out after log-checking.

Looking at the QSOs/hour over the entire 48-hour period, Chris came out ahead with an astounding average of 237+ QSOs completed *per hour* averaged over the entire contest period. This works out to almost 4 per minute, with 11,407 total reported QSOs (before log-checking). That is as a single operator unassisted!

And the likely winner of the SOAB category? CT1BOH, operating across the Atlantic at Cape Verde from D4C. Jose finished with a claimed 9,435 QSO count but more 3-point QSOs and more multipliers than either KL9A or N6MJ from their "2-point" stations.

Despite these new highs, we do note a small decline in the number of logs submitted for both the 2019 CQWW Phone and CW weekends. While the number of competitors may be slightly less, the number of contacts per hour by top CW operators nevertheless continues to increase. What will next year bring?

Contest Adjudication

Ever wonder what happens to your contest log after you submit it through the sponsor's online contest robot? The log-checking "adjudication" process is somewhat different for each contest and contest director, but there also are lots of steps in common with the checking of logs in most contests. Here is a podcast from the British ICQ Amateur / Ham Radio Podcast website that looks into the log checking process. Long-time RSGB contest adjudicator Simone Wilson, MØBOX, describes what she does to check logs submitted in RSGB competitions.

While not a description of CQWW or ARRL log-checking, the 18-minute interview nevertheless is well worth watching, especially if you really have no idea how your log may be checked during the adjudication stage. View the video at <https://tinyurl.com/yx5thbpu>.

New ARRL Online Groups Established

The ARRL has established new online fora and invited members to converse among themselves and with ARRL staff and leadership on topics of interest. "Contesting" is a recognized subject and is organized into five areas of interests: HF, VHF, QRP, Digital, and Beginners.

Providing a web area for contest discussions in this manner has some obvious advantages over privately-run reflectors, the most popular of which is "CQ-Contest." But whether the ARRL's initiative will succeed will be decided by whether contesters adopt it as a useful place to inhabit, ask questions, and exchange ideas.

One advantage of this type of communication is that the actual staff person involved with contest administration is part of the discussion and can relatively quickly answer questions without the give-and-take of speculative answers and opinions that seem to overtake many discussions on reflectors. On the ARRL site there seem to be present some members of the Contest Advisory Committee (CAC) as well. So when a question is raised, someone can respond who likely (1) knows the answer, and (2) can speak authoritatively for the sponsor. I have seen this level of involvement several times already, and it is beneficial in that everyone sees the answer quite quickly instead of exchanging dozens of speculative messages with no one really being in a position to give a correct answer.

The information that could be exchanged through these fora also will allow staff and CAC members, as well as others, to acquire a better understanding of concerns and to react to them if advisable. This assumes, of course, that contesters will become accustomed to using the fora to express their concerns and get their questions answered. With the plethora of media available, competition for contesters' attention is significant. You can check out this new capability at <www.arrl.org/forum>.

2020 Quartzfest Mini-Contest Distance Challenge

We tend to think of contests as being national or worldwide in scope. But onsite mini-contests, like the annual "eyeball sprint" contest at Dayton's Contest University, also can spark interest in contesting. While participants in Dayton already have expressed an interest in contesting by their attendance, a local event at a general club meeting or gathering might speak interest among some of the non-contesters in the group.

QuartzFest is one such event where a local contest challenge is being conducted. QuartzFest is a unique week-long ham radio, camping, learning and living event that is celebrating its 25th anniversary this year. It is held at a campground in the desert near Quartzsite, Arizona. Last year, this camping event attracted a little over 1,000 attendees. This year's event is scheduled to be held from January 19 through 25.

Attendees at the event can attend talks and participate in ham-oriented events on such topics as grounding and bonding essentials and radio direction finding, and non-ham events on such topics as 3D printing and basket weaving. Something for everyone, ham and non-ham. (It has been reported that some hams have non-ham interests as well, but this has not been independently confirmed. –*DS*)

I mention this event here because attendees also have an opportunity to participate in a min-contest of sorts. They can compete during three days of the event to make contact with the most distant station. This event might be a way to spark interest in contesting. This second annual Distance Challenge (DC) is sponsored by the Northern Arizona DX Association. Those camped at the week-long Quartzfest compete to see who can make the most distant contact from the camping area. Operators may use commercial antennas or bring in their own homebrew models.

This year the DC will be held on Monday, Tuesday, and Thursday, January 20th, 21st, and 23rd. Competition is SOAB only. The entry categories include CW, SSB, and FT-8, all with a 100-watt output power limit in one category and CW & SSB within a separate QRP category.

Participants who do not bring a rig or antenna can enter the competition using the site of special event station W7Q at certain times. Last year's contest winners were NK9G and KØVK, (*Photo A*). Prizes are awarded.

This might be an idea worth cloning.

– *Until next month, 73, Dave, K3ZJ*

PROPAGATION

BY TOMAS HOOD,* NW7US

The HF (+/-) Bands in 2020

A Quick Look at Current Cycle 24 Conditions
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, October 2019: 0
12-month smoothed, April 2019: 3

10.7 cm Flux:
Observed Monthly, October 2019: 67
12-month smoothed, April 2019: 70

A_p Index:
Observed Monthly, October 2019: 8
12-month smoothed, April 2019: 7

***One Year Ago:* A Quick Look at Solar Cycle Conditions**
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, October 2018: 3
12-month smoothed, April 2018: 5

10.7 cm Flux:
Observed Monthly, October 2018: 70
12-month smoothed, April 2018: 71

A_p Index:
Observed Monthly, October 2018: 7
12-month smoothed, April 2018: 8

CQWW SSB – How Did You Fare?

How did this period of high solar activity, massive flares, and major geomagnetic activity impact the CWWW SSB contest on October 26 and 27?

Day one, Saturday, saw active geomagnetic activity. The Planetary Estimated A index (A_p) was 25, while on day two, it was 15. With conditions slightly improving as the contest moved from day one to day two, activity was brisk from the 20-meter band down through 160 meters. As expected during the bottom of the solar cycle, the higher bands were not as productive as lower frequencies and played on mostly north / south paths.

Send in your contest propagation observations, and perhaps some of your reports will make it into publication in this column. There have been propagation surprises observed during contests. What have you witnessed?

Here is an overview of expected propagation conditions for 2020 on each amateur band between 6 and 160 meters.

6 Meters: This band will see very little DX from F-layer propagation, compared to the years of the solar cycle maximum. The summer season will bring the usual troposcatter (a.k.a. tropospheric scatter; see <https://tinyurl.com/no9fwh6>) and Sporadic-E (E_s) <https://tinyurl.com/z5ge3x3> activity. Aurora will still play a major role during spring and fall.

10 and 12 Meters: These bands will be poor, except during times of E_s activity. Expect most DX openings to be mostly on north / south paths, during hours of sunlight along the entire path. Most of the time, solar activity will not support propagation on higher bands.

15 Meters: This band will be poor to fair, only occasionally seeing worldwide openings during the daylight hours. Most openings will be short, except for the strong and frequent north / south path openings.

17 Meters: This band should behave much like 15, but you will find it open more often, and it should remain open for DX an hour or two longer than 15 meters.

20 Meters: Twenty will be the main player during this year of low solar activity — remember, we start this year at the very bottom of the solar cycle. Expect good conditions dur-

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LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for January 2020

	Expected Signal Quality			
Propagation Index	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 2-4, 6-9, 12-14, 20-22, 24-26, 29-31	A	A	B	C
High Normal: 1, 5, 10-11, 19, 23, 27-28	A	B	C	C-D
Low Normal: 17-18	B	C-B	C-D	D-E
Below Normal: 4,21,31	C	C-D	D-E	E
Disturbed: 18-20	C-D	D	E	E

Where expected signal quality is:
A--Excellent opening, exceptionally strong, steady signals greater than S9
B--Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.
C--Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.
D--Poor opening, with weak signals varying between S1 and S3, with considerable fading and noise.
E--No opening expected.

HOW TO USE THIS FORECAST

1) Using the **Propagation Charts** appearing in "The New Shortwave Propagation Handbook," by George Jacobs, Theodore J. Cohen, and R. B. Rose.

a) Find the Propagation Index associated with the particular path opening from the **Propagation Charts**.

b) With the Propagation Index, use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a Propagation Index of 1 will be fair to poor on January 1, fair on January 2 through January 4, then poor to fair on January 5, and so forth.

2) Alternatively, you may use the Last-Minute Forecast as a general guide to space weather and geomagnetic conditions throughout the month. When conditions are Above Normal, for example, the geomagnetic field should be quiet, and space weather should be mild. On the other hand, days marked as Disturbed will be riddled with geomagnetic storms. Propagation of radio signals in the HF spectrum will be affected by these geomagnetic conditions. In general, when conditions are High Normal to Above Normal, signals will be more reliable on a given path, when the ionosphere supports the path that is in consideration. This chart is updated daily at http://SunSpotWatch.com provided by NW7US.

ing the daylight hours, with worldwide DX openings possible throughout the year along the daylight / nighttime edge (the gray line terminator). DX conditions on this band tend to peak for a few hours after local sunrise and again during the sunset period. During the summer, expect the band to remain open for DX several hours after local sunset, occasionally later into the night. In the winter months of 2020, some nighttime DX openings are also expected.

30 Meters: As Cycle 24 departs, and Cycle 25 slowly increases in activity, this band will see moderate openings, especially from a few hours before sunset until a few hours after sunrise. In 2020, 30 meters will be an exciting band for those low-power digital signals. Winter brings longer nights, providing the right mix for exceptional worldwide DX.

40, 60, 80, and 160 Meters: These are nighttime DX bands. Great worldwide DX should continue on 40 meters from about 2 hours before sunset to approximately 2 hours after sunrise during all seasons. Expect coast-to-coast DX on 60 meters. DX openings on 80 and 160 meters should peak during the early spring, late fall, and winter months. Expect somewhat stronger signals than those of the last few years.

January Propagation

It should be a toss-up among 15, 17, and 20 meters for some great DX propagation openings during the daylight hours. These bands should open to most areas of the world, often with very strong signals. Fifteen meters may have a slight edge before noon, with 17 meters taking the lead after noon and becoming optimum for DX during the late afternoon hours. Twenty meters will offer all of that, but longer, and slightly earlier. Short-skip openings between distances of about 1,200 and 2,300 miles should be excellent during the daylight hours. Fair to moderate short-

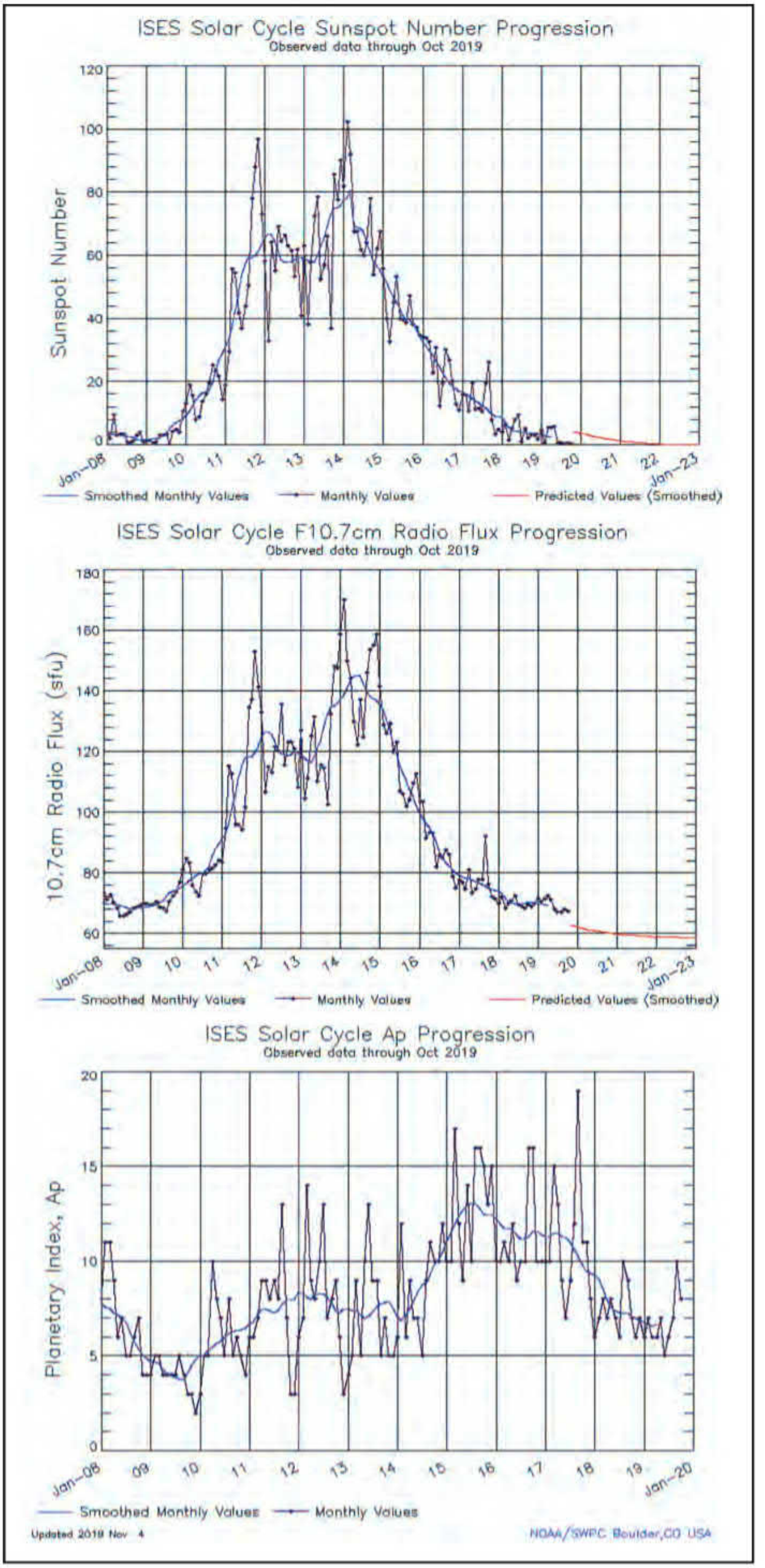

Figure 1. The most recent solar cycle (Cycle 24) is represented in several ways. At the top is the sunspot number; in the middle, the F10.7-cm radio flux; and at the bottom, the A_p Index (a measure of geomagnetic activity) history. In all of the plots, the black line represents the monthly averaged data and the blue line represents a 13-month smoothed version of the monthly averaged data. For the Sunspot Number and F10.7cm, the forecast for the rest of the solar cycle is given by the red line. (Courtesy of SWPC/NOAA)

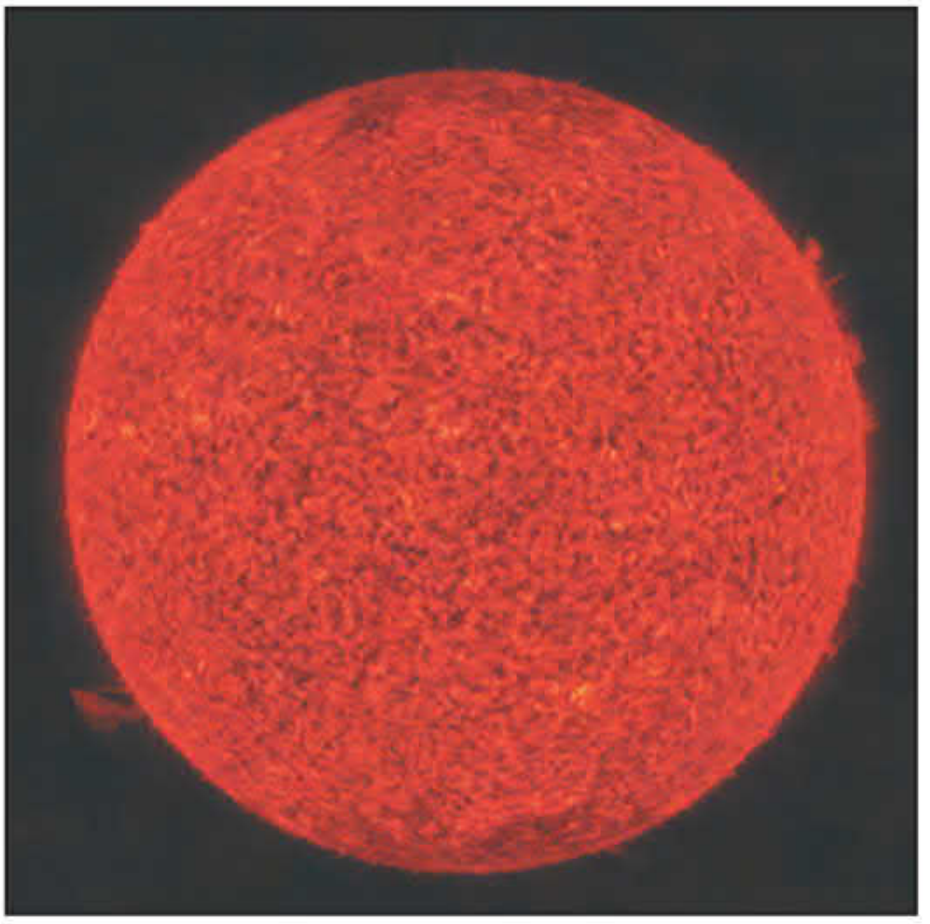

Figure 2. Notice the solar prominence rising off the Sun, in the lower left edge of the Sun in this image. This image is artificially colored red, as the picture is a capture of the 304-Angstrom wavelength sunlight as seen by the Solar Dynamics Observatory spacecraft. Right now, there's not much going on since we are at the bottom of the sunspot cycle. [Courtesy of Solar Dynamics Observatory (SDO)]

skip openings are expected on 15 and 17 meters from shortly after sunrise through the early evening hours for distances between 1,000 and 2,300 miles.

Twenty meters is expected to be a solid band with excellent around-the-clock openings for both DX and short skip. DX conditions should peak during a window of an hour or so right after sunrise and again during the late afternoon and early evening hours. Short-skip openings between approximately 1,300 and 2,300 miles should be possible from just after sunrise to as late as midnight. Shorter distance openings should also be possible from mid-morning to mid-afternoon.

The optimum band for DX conditions during the hours of darkness should be 40 meters, though 30 meters is a fair competitor when using digital modes or CW. Expect openings on both bands to most areas of the world from shortly before sundown, through the hours of darkness, until shortly after sunrise. Signal levels may be exceptionally strong at times. During the daylight hours, short-skip conditions should be optimal for openings between approximately 100 and 600 miles. Skip will lengthen during the late afternoon, and by nightfall, short-skip conditions should be optimal for openings between 800 and 2,300 miles.

Expect 60 meters to play a significant role in nightly DX across the United States. With very low noise levels this month, the weaker signals of 60 meters will be easy to copy.

Because atmospheric noise levels will be at seasonally minimum levels in the Northern Hemisphere during January, the 80- and 160-meter bands should be hot. Expect some good openings to many parts of the world on 80 meters during the hours of darkness and the sunrise period. Short-skip openings between distances of 50 and 250 miles should be optimal on 80 meters during the day. In the later afternoon and early evening hours, short-skip openings should increase to between 250 and 1,500 miles and by nightfall openings up to and beyond 2,300 miles should be possible.

Expect some DX openings on the 160-meter band during the hours of darkness. Openings toward Europe and the east should peak at about midnight. Openings toward the South Pacific and in a generally southerly direction may be possible just before daybreak, as well as openings into Asia and North Pacific. Short-skip openings up to 1,300 miles should be possible during the hours of darkness, and frequently the skip will extend out as far as 2,300 miles. During the daylight hours, intense ionospheric absorption will severely limit openings, although some may be possible, at times up to 150 miles or so.

VHF Conditions

E_S can occur during January, so be on the lookout. Very little Aurora is likely to occur, however, so don't expect Auroral-E propagation. The Quadrantids meteor shower is the major shower for January and it can appear any time during the first week of the month, peaking on the 4th. This can sometimes be quite intense, so it may be a good idea to set up some 2- and 6-meter schedules. Morning meteor openings may be the best bet during this month.

Check out <https://tinyurl.com/y59jwnl8> for a complete calendar of meteor showers in 2020.

If you use Twitter.com, you can follow <@hfradiospacewx> for hourly updates that include the K index numbers. You can also check the numbers at <http://SunSpotWatch.com>, where this columnist provides a wealth of current space weather details as well as links. Please report your observations of any notable propagation conditions, by writing this columnist via Twitter, or via the Space Weather and Radio Propagation Facebook page at <https://fb.me/spacewx.hfradio>.

Current Solar Cycle Progress

The Royal Observatory of Belgium reports that the monthly mean observed sunspot number for October 2019 was 0.2 (let's just call it zero). The 12-month running smoothed sunspot number centered on April 2019 is 2.6. A smoothed sunspot count of 3, give or take about 3 points, is expected for January 2020.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 67.4 for October 2019. The 12-month smoothed 10.7-cm flux centered on April 2019 is 69.6. The predicted smoothed 10.7-cm solar flux for January 2020 is 64, give or take 4 points.

The observed monthly mean planetary A-Index (A_p) for October 2019 was 8. The 12-month smoothed A_p index centered on April 2019 is 6.7.

Geomagnetic activity this month should be mostly quiet with fair to good propagation conditions, except for those days indicated in the Last-Minute Forecast during which we expect degraded propagation (remember that you can get an up-to-the-day last-minute forecast on the main page at <http://SunSpotWatch.com> –*TH*).

I welcome your thoughts, questions, and experiences regarding this fascinating science of propagation. You may email me, write me a letter, or catch me on the HF amateur bands. If you are on Facebook, check out <https://fb.me/spacewx.hfradio> and <https://fb.me/NW7US> — speaking of Facebook — check out the *CQ Amateur Radio* Magazine fan page at <https://fb.me/CQMag>. – *73, Tomas, NW7US*

As we celebrate Our 75th Anniversary we want to say "thank you" to the advertisers listed below, and to all our advertisers over the years, who have made these 75 years possible!

100 Watts and a Wire – Ad on page 93
www.100wattsandawire.com

Launched on June 22, 2015, the show features topical conversation, interviews and news, Join Christian, K0STH at the intersection of life and amateur radio and follow a journey of discovery through this important public service and hobby. Subscribe wherever you get your podcasts – Sunday evenings HF NET: 7 pm Central – Frequency and band may vary. But, it will be posted on social media. The show can also be heard on 14 broadcast affiliates, including shortwave stations WTWW5085 MHz and WBCQ5130 MHz. Be sure to subscribe to our new YouTube Channel for 100 Watts and a Wire video extras!

Advanced Specialties Inc. – Ad on page 47
114 Essex Street, Lodi, NJ Telephone: 201-VHF-2067
Website: www.advancedspecialties.net

Advanced Specialties Inc. has been New Jersey's longest operating Storefront Radio Dealer, serving the NY and NJ areas for almost 30 years at their same Lodi, NJ location. The Store carries a wide selection of Amateur radio equipment and accessories, as well as Police Scanners, CB and GMRS radio items, and related Books, magazines, Antennas mounts, cables, adapters and more!

The owner , John, has over the years, been a staff writer for National Communications Magazine, and CQ's earlier sister publication CB Radio Magazine. He also has helped, and given suggestions to leading manufacturers, that resulted in new products for the US market, and Advanced Specialties was also the distributor for RMS of Italy brand Radio meters, amps and accessories.

Many Ham radio related "props" seen on New York based TV and movie productions have often been purchased from Advanced Specialties. The store is open Tuesday through Saturdays , give them a call at 201-843-2067.

Air Boss • Innovative Tech • Antenna Launcher – Ad on page 99
Telephone: 252-249-0287 – Website: www.kr4loairboss.com

The Air Boss Antenna Launcher was designed to launch a light fishing line over trees in order to create temporary antenna for ham radio operators. Since then it has also found other uses installing cable in ceiling voids. The Air Boss Antenna Launcher uses compressed air to launch a 2 oz lead weight pulling a light fishing line. Once the weight is retrieved, the antenna or another line can be fastened to the fishing line and the line retrieved to erect the antenna.

AlasKitEducational & Scientific Resources – Ad on page 21
Telephone: 907-488-0483 – Website: http://alaskit.co

We have a large inventory of new and surplus genuine radio components, from QRP to QRO. If you can't find it, we probably have it! AlasKit has a well-equipped RF design lab. If you hae a need for a custom-designed RD accessory, we can design and produce these in single lot, or small production quantities. We produce a winde range of training materials and technical documentation. If you need a technical manual written in clear, concise English, we can do that too!

Alinco – Ads on pages 33, 61
Telephone: 510-298-5100 -
Website: https://remtronix.com/
http://www.alinco.com

Alinco was founded in 1938 in Osaka, Japan and has been a trusted source for both amateur and business communications equipment for over four decades. Alinco is a manufacturer of transceivers, receivers and power supplies as well as a wide variety of accessories.

Amateur Radio Roundtable – Ad on page 101
W5KUB.COM (Tom Medlin) webcasting began in 2001 and has come a long way since those days of experimentation, low bandwidth. crude webcams, and operating with zero funding. The early webcasting days were mostly for fun and an attempt to stream a long road trip or ham event so his friends could watch. Tom realized that there was a possibility to use this webcasting to help spread the word about ham radio, to help others see many different aspects of the hobby.

He also realized that many hams are very young and could never travel to hamfests. Many others could not enjoy this ham experience due to sickness, age, financial issues, long geographic distances. So that is where the real webcast service to ham radio was born. It was to let all these other people be a part of hamfests and special ham radio activities even if they could not attend. Over the years the webcast has had viewers in over 150 countries, with tens of thousands watching a single event like Hamvention. W5KUB.COM awards about $10,000 in prizes to online viewers every year.

ARLAN Communications – Ad on page 51
PO Box 1610, San Luis Obispo, CA 93406-1610
Telephone: 805-504-3944
Website: www.arlancommunications.com

Listen-Only Headsets and Boom-Mic Headsets for Ham Radio - Headsets designed specifically for Amateur Radio, backed by more than 30 years building commercial communications headsets for OEMs in the aviation, emergency response, industrial, public safety and racing industries to create superlative headsets with unmatched flexibility and strength that provides trouble free operation backed by an unprecedented 5 year warranty.

Ten reasons you want a ***radiosport*** Boom-Mic Headset: (1) rugged construction, (2) up to 24 dB noise reduction, (3) rugged headset-to-radio cables built with Belden's Kevlar reinforced leads with Teflon insulation, (4) user interchangeable headset-to-radio cables designed specifically for your radio, (5) industry standard Switchcraft miniXLR headset radio port, (6) user interchangeable microphones custom made for our gear, (7) built-in PTT on the headset, (8) auxiliary radio port, (9) spare parts for nearly every headset our factory has built since 1992, (10) Quality Accessories to match your headset.

BUDDIPOLE – Ad on page 19 MASTWERKS – Ad on page 71
3028 SE 59th Ct. #600, Hillsboro, OR 97123
Telephone: 503-591 8001
Website: Buddipole: http://www.buddipole.com
Mastwerks: https://www.mastwerks.com/

The BUDDIPOLE Portable Dipole fits in your travel bag and assembles in minutes. It's more than an antenna, it's a versatile system for launching your signal. Optimized for transmit power and proven for DX work, the BUDDIPOLE is the secret weapon used by HF portable operators all over the world. We offer different kits that will give you heights ranging from 9.5 ft to 19 ft.

Designed by Budd Drummond, W3FF in 2000. The company is now run by his son Chris Drummond, W6HFP. It is said the height of your antenna can make all the difference whether you're operating VHF/UHF or trying to maximize your take off angle for some good DX on HF. With that in mind, we spent a significant about of time researching and developing a mast system that is still portable and reaches heights to match antennas mounted on buildings. We have launched a brand new company called MASTWERKS, rotational tripod and mast systems. The new RTS 1500 series can reach heights up to 32ft and is designed with a rotating tripod head that can be operated manually by a hand-crank or remotely utilizing a small motor and remote control unit.

We have been told our systems are a joy to build and use and works like a charm. Visit our websites for more info and pricing. Mastwerks: https://www.mastwerks.com/ Buddipole: http://www.buddipole.com/

C. Crane – Ad on page 63
172 Main Street Fortuna, CA 95540-1816
Telephone: 800-522-8863 - Website:www.ccrane.com

C. Crane's radio division began soon after Bob and Sue Crane moved from the San Francisco Bay Area to the beautiful and remote Redwood Country of far Northern California. As they settled into Fortuna, nestled in the heart of the Redwoods, Bob tried to tune in his favorite Bay-Area radio station, KGO and was shocked when he couldn't receive it during the day. Bob spent many hours during the day in his woodshop and found that he missed listening to his favorite radio station.

After about a year of searching, the Cranes found a simple antenna for AM that allowed them to listen to KGO Radio, over 250 miles away during the day – even through the trees. Bob and Sue knew they had to get the word out. So, they decided to expand their company to market this wonderful antenna. They advertised the antenna on the radio, and after a few learning experiences, the C. Crane radio division was up and running. Bob, Sue and Grandma Faye were the first phone operators. That was over 30 years ago.

Since selling their first AM antenna, C. Crane has become a premier electronics company. They have developed several radios designed for long range radio reception and audio tuned for voice clarity. After several near 7.0 earthquakes, in

1992 they added an emergency radio and light products that would become essentials during an emergency event anywhere in the country. In recent years, they have expanded their product line to include Extended Long Range WiFi Receiver Systems designed to receive a distant available WiFi signal that repeats a new WiFi signal to a dead zone, for use by all devices.

With the help of dedicated employees and the support of many loyal radio enthusiasts, the company has transformed from its humble beginnings into the company that it is today.

Communication Concepts, Inc. – Ad on page 69

508 Millstone Drive, Beavercreek, OH 45434
Telephone: 937-426-8600
Website: www.communication-concepts.co

Communication Concepts, Inc. was founded in April, 1979 in Kettering, OH to supply components to the amateur radio enthusiast who wanted to construct the amplifiers described in the Motorola Application Notes and Engineering Bulletins. In August 1988, we moved to our present location in Beavercreek, OH which is near Dayton, OH. Since then, we have increased our product line. In June, 2012 we added several amplifier designs by Freescale. We ship our products to countries throughout the world. Visit our website to view our complete product line and pricing.

Compudigital – Ad on page 43

Telephone: 915-205-2200 – Website: k6iok.com

Compudigital Industries started out as a research and development company in 1983. We've developed many creative products.

Jeff Hilliard, the president (AK6OK) has been a ham for so long, he decided to continue in the R&D business but in the direction of resurrecting old ham equipment. This new direction started with a replacement power supply kit for the Kenwood TS-930 and TS-940, two of the best vintage radios ever made by Kenwood. We just can't let those good old transceivers die!

Compudigital continues to resurrect old transceivers and amplifiers with more secret projects to come!! Stay tuned! You can see these products at k6iok.com!

EZ Hang – Ad on page 75

75 Goldfinch Way, Capon Bridge, WV 26711
Telephone: 304-856-1026 • Website: www.ezhang.com

EZ Hang went into production in 1998. Its basic construction is welded/bolted steel attached to a reel that is corrosion-resistant plastic and stainless steel. The reel comes with 300 feet of 10-pound-test monofilament line installed, a quick disconnect clip to release the weight and an easy-to-see "bright yellow powder coated" custom cannon ball one-ounce lead weight.

We are the only patented device on the market. Our product is quality built and made to last a lifetime. With over 16,000 sold around the world, and we do not have one dissatisfied customer. We at EZ Hang make customer satisfaction our number one goal. Visit our website for more info and pricing.

ELECRAFT

125 Westridge Drive, Watsonville, CA 95076
Telephone: 831-763-4211 • Website: www.elecraft.com

Founded in 1998, Elecraft offers full-featured transceivers and accessories both factory-assembled and easy-to-build kits. The latter makes them unique among major ham manufacturers.

Elecraft's founders (Wayne Burdick, N6KR, and Eric Swartz, WA6HHQ) trace their company's roots back to Field Day – the ultimate proving ground for many hams. Their design philosophy was clear from the beginning: Their radios would offer both high performance *and* portability. These two goals have spawned seven complete transceiver product lines.

It all began with the K2, a three-pound, all-HF-band, all-mode radio with a traditional desktop form-factor. The K2 achieved wide acclaim from users and testing organizations alike, and is still available today as a full kit, in 10- and 100-watt models. From there, Elecraft's transceivers branched in two directions. One emphasized ultra-portability, while the other was optimized for desktop use.

The ultra-portable lineage started in 2001 with the K1 and later the KX1 (both CW only, covering up to four bands). Both enjoyed loyal followings among QRP operators and first-time kit builders, though they are no longer available. Today, the lineup consists of two of the most highly integrated and power-efficient small radios ever offered: the all-band/all-mode KX2 and KX3. Both are "trail-friendly" SDRs (software-defined radios) with controls and display on top, attachable keyer paddle in the front, internal batteries, and an internal wide-range automatic antenna tuner. They can even be used hand-held. Both feature a wide range of DSP-based operating features and very low current drain, and are favored by portable operators around the world for SOTA, HF pack, and lightweight DXpedition use. A 100-watt amplifier (KXPA100) is available to transform KX-line radios into powerful home or mobile stations.

Meanwhile, Elecraft's desktop line progressed from the K3, to the K3S, and most recently to the K4. Thanks to its superhet receiver's performance, the K3 quickly became the rig of choice for many contest, DXpedition, and multi-transmitter stations. The K4 builds on the K3's legacy, but with a twist: it uses a high-performance SDR architecture in its basic form that can be outfitted with a dual-superhet front end for stations that experience extreme signal levels.

Elecraft has also earned a reputation as a premier supplier of high-power, solid-state linear amplifiers. Their first amp, the KPA500, is a compact, dependable workhorse in use by thousands of hams. It has a companion 500-watt ATU (KAT500). Also available is the full-legal-limit KPA1500, which includes an internal ATU and space-saving separate power supply. The KPA1500 and K4 share the same enclosure size and styling, together forming Elecraft's flagship "twins."

Elecraft's goal for the future is to continue to innovate in directions that benefit its customers. To this end, the company actively participates in its vibrant user community. It has always emphasized both "hands-on ham radio" and uncompromising customer support.

From the Elecraft team: We're based in Watsonville, California on the Monterey Bay, on the western slope of the Santa Cruz mountains. (Just outside of Silicon Valley.) We have a focused and experienced staff, as well as many talented customer/designers who contribute their ideas and expertise. **Please visit our website, www.elecraft.com**

Electric Radio – Ad on page 99

PO Box 242, Bailey CO 80421-0242
Website: ermag.com

Electric Radio magazine, now in circulation over 30 years, is published primarily for those who appreciate and continue to use vintage radio communications equipment and also for those who are interested in the rich history of radio.

You can also purchase a number of related products like the popular Collins and Hamarlund repair DVDs, Drake data CDs, Inrush Current Limiters, many books and other products.

We depend on our readers to supply material for *Electric Radio*. We invite those interested in writing for *Electric Radio* to write, call, or e-mail the editor.

HamEstate

Telephone: 833-891-0073 – Website: www.hamestate.com

One thing most of us do not think about much is what happens to our equipment, towers and antennas when we pass on. An even bigger question we do not address is who is going to take this burden away from our grieving loved ones, so they do not have to deal with this cumbersome task.

I am blessed to be president of a company that deals with radio equipment, towers, antennas and other telecommunications systems on a commercial basis. Since I had the infrastructure, staff and other resources in place, why not expand this into my hobby so others can benefit from this service? I started HamEstate.com.

For a monthly subscription fee you will get peace of mind that someone will have your family's best interest at heart handling your ham radio equipment sale when you pass away and giving them the privacy they deserve. Visit our website and click on the How It Works link for more information.

Ham&HiFi

155 Glendale Ave (suite 12), Sparks, Nevada 89431
Telephone: 866-988-0073 • Website: ham&hifi.com

We opened our doors in 2014 and since then we've added four employees to the team, creating a wealth of knowledge. Whether it's amateur radio, high fidelity audio, or tubes, we have someone who can assist you!

Whether it's answering questions about an item you are interested in, or purchasing your surplus equipment, we're here to help. Give us a call and we'll get back to you as soon as possible!

HamTestOnline – Ad on page 47

Telephone: 888-857-6164 - Website: www.hamtestonline.com

HamTestOnline provides online courses for the U.S. ham radio license exams. We integrate study materials with question drill, using the actual exam questions and answers. We track your progress and focuses on your weak areas, drilling questions you get wrong more often than ones you get right. It's a *powerful* combination.

We are top-rated on eHam.net — 97% of reviewers give us 5 stars. We have more 5-star user reviews than *all other study methods combined!* Try for yourself — the first 50 questions are free. Success guaranteed — if you fail the amateur radio license exam, we refund your subscription. *It's a no-brainer — you pass the exam or get a full refund!*

HamTestOnline costs about the same as the ham radio license manuals, and we provide a lot more value. Visit our website for complete info!

Icom America Inc. – Ad on page 25

12421 Willows Rd. NE, Kirkland, WA 98034
Telephone: 800-USA-ICOM (800-872-4266)
Website: http://www.icomamerica.com

Icom America Inc. (1979) is a part of Icom Incorporated. Icom Inc. started in 1954 by Tokuzo Inoue in Osaka, Japan, who developed strong roots in designing, engineering, and manufacturing highly advanced, compact solid-state radio equipment for use in the Amateur (ham) Radio industry. The company's product

line has since expanded to include communications equipment and products based in the marine, avionics, land mobile, wide-band receiver and networking solutions.

At the front of the Amateur Radio market, also known as ham radio, Icom designs and produces radios for use in long-range (HF) and short-range (VHF, UHF) communications. Icom has transformed these segments with Digital technology, from being a pioneer with the development of Digital Signal Processing (DSP) equipment to development of products to use with the first Digital Voice protocol developed around Amateur Radio, D-STAR, a global open protocol that is on the cutting edge in Amateur Radio today.

Icom also leads the amateur radio industry with Direct Sampling, Software Defined Radio technology with the IC-9700, Amateur Radio's first VHF/UHF Direct Sampling radio. Additionally, Icom is leading the way in remote base operation with Amateur Radio's first direct connect remote base software package introduced with the RS-BA1 software, requiring a firmware update to activate the IC-7800's remote server. **For the love of ham radio.**

KJI ELECTRONICS – Ad on page 68
610 Pompton Avenue, Cedar Grove, NJ 07009
Telephone: 973-571-1930 – Website: www.kjielectronics.com

Serving the Amateur Radio community since 1978 – we are a full-line dealer – ICOM, Kenwood, Yaesu, Heil, LDG and more!

JVCKENWOOD USA Corporation – Ad Cover 2
Communications Sector, 1440 Corporate Drive, Irving, TX 75038
Amateur Radio – Phone : 310-639-4200 (Option 4, Option 1)
www.kenwood.com/usa

JVCKENWOOD Corporation is a leading developer and manufacturer of consumer electronics and communications equipment. Founded in the United States in 1961, JVCKENWOOD is the largest sales subsidiary of JVCKENWOOD Corporation of Japan and is recognized for providing products known for quality, performance, and value.

JVCKENWOOD USA has a reputation for bringing important new products to market. The company built the first audio/video amplifier for home theater in 1981, the first anti-theft car cassette deck and the first with automatic noise reduction. JVCKENWOOD engineers are recognized for inventing dozens of new technologies that were later copied by others.

JVCKENWOOD USA Communications Sector, based in Irving, TX maintains a leadership position in North and South America for mobile and portable two-way radios and custom systems. Upon entering the U.S. radio equipment market in 1975, JVCKENWOOD quickly became known for its dedication to quality. This led to an immediate demand for its professional land mobile radio products when introduced to American business and government buyers in 1983. KENWOOD land mobile portables, mobiles and custom systems are acknowledged to be a top choice in the world market, particularly by first responders, and KENWOOD radios are trusted by business and industry.

In addition, JVCKENWOOD's dominance in the U.S. amateur radio market has been recognized for more than 30 years. KENWOOD amateur radio products are the number one choice for ham operators who are on the forefront of civilian emergency response.

Today, JVCKENWOOD USA takes a leading role in developing market-driven products and operates as one of the largest manufacturers of communications equipment and personal entertainment products in the world. A central tenet of JVCKENWOOD is its commitment to listening to the market and developing products engineered at the highest level to address customers' needs and provide maximum value.

LDG Electronics – Ads on pages 56, 57
1445 Parran Road, St. Leonard MD 20685
Telephone: 410-586-2177 Website: www.ldgelectronics.com

In 1995, LDG Electronics was founded by three Engineers; Larry, Dwayne, and Gene from Naval Air Station, Patuxent River, MD. The products were Single Board hobby Computers based around the Motorola 68HC11. Soon after, the first desktop automatic tuner was built around the 68HC11 Processor.

With the sunspots at a minimum, LDG officially entered the amateur radio market with the AT-11 Automatic Tuner Kit featured in Jan 1996 QST. The response was literally overwhelming with backorders of backorders for those wanting to build the latest in 1990's technology.

Now nearly 25 years later, LDG has grown to provide a variety of Antenna Matching Accessories across a wide range of installations. Owners Dwayne and Jennifer Kincaid are proud to have built a family run business that supports Amateur Radio around the world. We congratulate CQ Magazine for their 75th year and wish them continued success in providing the "human touch" connection to the hobby.

Pacific Antenna – Ad on page 99
PO Box 10301, Fayetteville, AR 72703
Email: qrpkits.com@gmail.com - Website: www.qrpkits.com

At Pacific Antenna, our goal is to make kit building an enjoyable and rewarding experience. We provide quality, affordable kits along with support through the build process and beyond. We fully support our products and will replace any failed component, for the life of the product, for any reason. If you lose, damage, burn out, or install a component in error, and need a replacement, simply contac us, pay the postage, and we will ship a replacement.

PARADANradio
Website: www.paradanradio.com

World-class Amateur Radio Products made in the U.S.A. **Paradan Radio** started shortly after lightning surges damaged both my station N1ZZ and W1BV's station. Neither one of us had switched our antenna feedlines to ground, nor had we disconnected our coax lines. So, to avoid this surge damage problem in the future I assembled a relay switch to automatically disconnect the coax cable from the radio and to ground the antenna's coax shield and center. This occurs when the radio is turned off. When we turn the radio on, the antenna is properly connected. It's worked well all summer long….. no damages during lightning storms. At this time I was developing and manufacturing other handy ham radio devices for others. So it made sense to develop this lightning surge protector too and also to start selling all these products myself.

Our products are well made here in the USA and they work well. Check them out on our website.

PowerPort by Cutting Edge Enterprises – Ad on page 75
Telephone: 831-427-8197 – Website: www.powerportstore.com

We are the designers and manufacturers of PowerPort line of products: portable power supplies, pouches, bags and communications accessories. The PowerPort line was originally the product of a restless inventor's needs. My fascination with both wilderness travel and electronics made the lack of adequate portable equipment painfully obvious to me. Throw into the equation living through a number of serious natural disasters, and you can see where my bent toward emergency preparedness has its source.

I formed this company to design one of the best lines of hand portable power supplies and communications accessories on the market. These products are rigorously tested in the field to give you equipment that is easy to use, comfortable to carry, and sturdy enough to hold up to serious wear and tear.

Today, our products are used throughout the world. We are committed to excellence in the quality, design, and usability of our products. I invite you to join our community of satisfied customers!

PreciseRF – Ad on page 13
13690 Westeria Dr NE, Aurora, Oregon 97002
Telephone: 503-915-2490 – Website: www.preciserf.com

PreciseRF was created by retired Tektronix engineer Roger M. Stenbock (W1RMS). At Tektronix, he was a design engineer for the 2200 series oscilloscopes FG501, FG502, FG503, and FG504 function generators. He noted that while there are many cost-effective SWR measurement devices available, no affordable precision wideband RF samplers, directional couplers, return loss bridges and wideband demodulators were readily available for the amateur radio enthusiast with access to a low-cost scope.

"We continue to focus on premium precision products and have applied this to our antenna product line as well," said Roger. Beginning in 2017, PreciseRF introduced a full line of premium magnetic loop antennas (MLA). They featured portable, remotely tuned, and outdoor water-resistant models.

In addition to Roger, the PreciseRF team also includes Robert Kirkpatrick (KI6HNA) who brings over 35 years of electronic design, manufacturing and compliance testing experience from Silicon Valley, most notably in the high-end consumer electronics field. Receiving his amateur radio extra class licenses in 2009, Rob joined Roger in the development of the PreciseRF product line by reviewing designs, making design suggestions and improvements and then developing the actual products for manufacturing. His knowledge about components, CAD tools, PCB design, vendor and suppliers allows him to make quick turn-around on prototype designs.

Travis Cannon joined the PreciseRF team as a software engineer and technology consultant. With degrees in computer and software engineering from the Oregon Institute of Technology, as well as an MBA from Portland State University, he brings a unique blend of business and technical savvy.

And Audrie Crane, who has been with PreciseRF since day one. In addition to being our key manufacturing person, you'll find her also at the order desk. She is no newcomer to the high technology market place, having distinguished herself at MentorPlus Software and Stenbock Communications. She prides herself on delivering the best possible product quality and customer service while keeping the whole operation running. Visit our website to view our entire product line!

Quarter Century Wireless Association Inc. – Ad on page 68
Website: https://www.qcwa.org/qcwa.php

Mission Statement: To promote friendship and cooperation among Amateur Radio (Wireless) operators who were licensed as such at least a quarter of a century ago.

To operate exclusively for charitable, educational and scientific purposes, and more specifically to promote interest in Amateur Radio Communications and the advancement of the electronic art; to use the reservoir of knowledge and experience represented within the membership of QCWA for the benefit of all Radio Amateurs, and the furtherance of the Public welfare through Amateur Radio Communications; to support scholarship(s) for deserving Amateurs pursuing higher educational objectives; to encourage participation in QCWA chapter meetings and local amateur radio and public interest groups. View website for complete info.

REACT International, Inc. – Ad on page 94
POB 21064, Dept. CG001, Glendale, CA 91221
Telephone: 3301-316-2900 – Website: http://www.reactintl.org

"REACT International, Inc. (***Radio Emergency Associated Communications Teams***) – consisting of Teams of Skilled Communications Volunteers – is a non-profit registered 501(c)3 organization.

We will be 60 years old in 2022 and we are looking for members! Email RI.HQ@REACTIntl.org or call 1-301-316-2900 for details on how to join or to start a Team!

RF Parts – Ads on pages 27, 79
435 S. Pacific Street, San Marcos, CQ 92078
Telephone: 760-744-0700 • Website: www.rfparts.com

RF Parts Company, is an American-owned company, offering a wide variety of parts for manufacturing and servicing communications equipment. Including: RF Power Modules, Transistors & Integrated Circuits, Rectifiers-Diodes-Zeners-Bridge Rectifiers, Tubes & Sockets, Capacitors, Resistors, Chokes & Combiners, Transformers, Relays, Fans, Filters, Heliax Coaxiial Cable, Coaxial Cable & Accessories, Connectors, Adapters, Wattmeters, Dummy Loads & Attenuators, Power Supply – Multimeters – Antennas, Books & Manuals

RT Systems – Ads on pages 9, 69
267 S Davis Road, LaGrange, GA 30240
Telehone: 800-921-4834 • Website: www.rtsystems.com

For almost 25 years, RT Systems has produced the most up-to-date amateur radio software for all the top radio manufacturers. Along with the most reliable software, RT Systems makes the best cables for programming and/or control.

RT Systems invented amateur radio programming in 1995 when the Yaesu FT-11 "cloned". "We wondered if they could get the radio to talk to a computer instead of another radio: and we did! The rest is history." There is not a radio produced today that does not have the ability to be programmed from the computer. The forward thinking of the originators of RT Systems initiated a major change in the equipment which then lead to development of more features in many models.

RT Systems provides a system that works! The system includes an RT Systems Programmer designed specifically for your radio (nothing extra to wade through) and an RT Systems USB cable designed to work with your radio and eliminate com port setup. Some radios use generic computer cables or on-board USB electronics. RT Systems programmers are designed to work with those where possible.

The RT Systems programmers are now moving to delivery via on-line download. While a little scary for those of you who have for so long only known software on disk, this option has lots of advantages. First and foremost, you don't have to store a disk and there is less waste in the environment. Secondly, you can get a fresh installer when you need it. This allows RT Systems to keep up with operating system changes that affect the installers. Best of all, you have the programmer immediately to use with that new radio. Given you can copy and paste details from one programmer to another, you'll have that new radio ready to go in minutes! Visit our website for complete details

SteppIR Communication Systems – Ad on Page 1
13406 SE 32nd Street, Bellevue, WA 98005
Telephone: 425-453-1910 – Website: www.steppir.com

Founded in 2001 and located in Bellevue, WA, From large-scale, commercial-grade enterprise systems to high-end amateur radio offerings, SteppIR is the leading global HF-communication solution provider. Powered by or patented technology that provides the highest quality and most reliable system in the market, we are pleased to support your communication needs. From emergency management to HFT (high frequency trading) to remote date (IoT) data collection, we have your answers.

SteppIR is a product engineering company focused on delivering the best quality and highest reliability communications solutions. Our engineering and manufacturing teams are experts in HF-communication systems and can meet virtually any requirements placed in front of them. We offer an array of commercial horizontal and vertical antennas as well as controllers, analyzers, amplifiers and other system components. Our goal is to offer you the highest quality and most reliable communications system available.

SwapMyRigs.com – Ad on page 47
Telephone: 850-385-3769 – Website: www.swapmyrigs.com

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Tashjian Towers – Ad on page 99
2765 S. Temperance, Fowler, CA 93624
Telephone: 559-834-4300 - Website www.tashtowers.com; email Norman@tashtowers.com

Tashjian Tower is an engineering and manufacturing business dedicated and motivated to serving customers by providing: 1.) Quality services and products, on time, and within your budget; 2.) Superior work environment for employees to perform superior work; 3.) Enjoyable experiences for all involved. Visit our website to view our product line and download a catalog.

W2IHY Technologies Inc. – Ad on page 101
19 Vanessa Lane, Staatsburg, NY 12580
Telephone: 845-889-4253 - Website: www.w2ihy.com

W2IHY Technologies specializes in affordable audio technology for amateur radio applications. We are the only manufacturer that specializes in the design and the manufacturing of audio and RF switching equipment that work together in your station environment. Our products are built to be used in transmitting environments where RFI and less-than-perfect ground systems can compromise the performance of audio equipment. Extensive RF Isolation and Audio Isolation solutions are designed into all W2IHY products.

The legendary W2IHY EQPlus, 8-Band Audio Equalizers/Noise Gates, iBox and iPlus audio switching units are in use worldwide. We also provide high-quality, custom-made cables for all of your audio needs.

Technical Support and Customer Service are readily available via telephone and email. Our goal is 100% Customer Satisfaction. All products are manufactured in the USA. Free Technical Support and 3-Year Warranty. 30 Day No Questions Asked Money Back Guarantee on products purchased direct from W2IHY.

W5SWL Electronics – Ad on page 99
Website: www.w5swl.com

The owner, Dave spent about 10 years working in and running Radio Shack stores. In 1981 after leaving Radio Shack, Dave started his first mail order endeavor. That business sold home satellite dishes and was one of the first and few merchants to offer the "Big DIsh" via mail order in the country along with local sales and service to home and business. A lot has transpired since those early days, now we specialize in quality "RF Connectors & Gadgets" along with technical parts, books and ham radio products. The W5SWL team's motto is excellent customer service and response.

Excellent quality connectors, the "W5SWL" brand connector is first tested for fit and usage. Once it is determined that the connector is suitable physically we perform as needed RL (Return Loss) / VSWR testing and other tests via our in-house test facility (we have a extensive in-house test lab) to determine if the connector is suitable performance wise. Only then will we include the connector in our line for sale to our customers. Check out our entire selection on our website.

W5YI Group – Ad on page 35
2000 E. Randol Mill Road, Suite #608-A, Arlington, TX 76011
Telephone: 817-274-0400 – Website: www.w5yi.org

Our Primary Mission is offering products and services to assist individuals in obtaining FCC Ham Radio and Commercial Radio Operator Licenses. The W5YI Organization consists of three separate business operations: W5YI Group, W5YI-VEC and National Radio Examiners. Visit our website for complete info.

West Mountain Radio
1020 Spring City Drive, Waukesha, WI 53186
Telephone: 262-522-6503 – Website: www.westmountainradio.com

West Mountain Radio is a company specializing in products for DC power distribution and control, amateur radio and R/C hobbies. We manufacture RIGrunner DC power strips, voltage monitors and tools, precision battery analysis hardware and software, and RIGblaster sound card interfaces for amateur radio digital mode communication. Products designed, tested and used by ham radio operators onsite. Check out our website to view our product line.

Yaesu USA – Ads on pages 6, 7, 17, Cover 4
6125 Phyllis Drive
Cypress, CA 90630 USA
Telephone: 714-827-7600 – Website: www.yaesu.com

The Yaesu brand is well known among ham radio aficionados and is synonymous with premium quality ham radios. From stationary multi-feature communications equipment to portable devices, YAESU has consistently represented the best in communications equipment to the world's top DX'ers for over half a century. Visit our website to view our entire product line.

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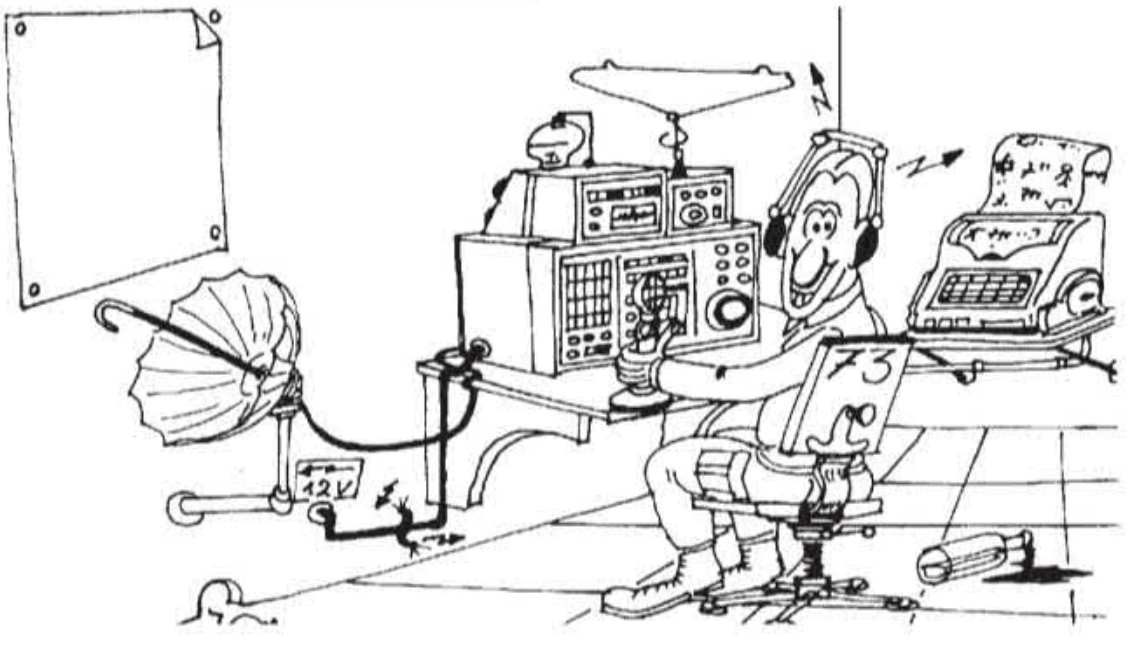

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HF/50/144/430MHz 100W All Mode Transceiver

FT-857D

Operating Modes: CW/SSB/AM/FM * C4FM digital mode is not supported

- Ultra-Compact Package (6.1" x 2.0" x 9.2")
- The 4 Pole Roofing Filter (MCF) and 11 Band Pass Filter RF stages
- Large Radio Tuning Dial and Outstanding Ergonomics

The Ultimate Backpack Multi-Mode Portable Transceiver

HF/50/144/430MHz 6W All Mode Transceiver

FT-818ND NEW

Operating Modes: CW/SSB/AM/FM * C4FM digital mode is not supported

- Incredibly Small Size (5.3" x 1.5" x 6.5") and Light Weight (under 2 pounds)
- High Frequency Stability (±0.5ppm) TCXO Included
- 6Watts of TX Output Power (AM: 2Watts)
- 1900mAh Ni-MH Battery Pack and Battery Charger Included
- AA Alkaline Battery Operation

YAESU
The radio

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

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