Well, it is already a start of a new year! Where did the last year go? Hope 2020 starts and continues well for all of you. Your OCARC 2020 Board has already met and are off to a good start and I want to thank all members of the 2019 Board for all the efforts.

The club auction was delayed until this month so please read all about it in this newsletter. We have an enthusiastic auctioneer lined up and hope every seller gets a brief description of their items ready so that the auction runs even smoother. We are also trying something new this year: Since sellers have to wait to collect until all buyers pay it can take some time after the auction. We will be accepting self-addressed, stamped envelopes from the sellers and we would mail your check home. You can still pick up your funds at the meeting of course.

With the AUCTION and Winter Field Day both in January (both in this “RF” publication) and January being a short OCARC month due to how the calendar falls, we have a lot to do in a short period of time. We have some interesting speakers being scheduled this year and our Field Day effort is going to need to be started. The By-laws are also getting a much-needed update as is our OCARC advertising brochure. Hopefully many good things coming in 2020.

The Board will also need member assistance in various ways. Keep reading the OCARC "RF" and listen carefully at the monthly meetings for opportunities where you can be of help! If you have topics, speakers and contacts for future meetings please let our VP know. Also keep your mind open to running for an Officer position for next year. We have many on the Board that will be termed out this year and we will need some new Officers. Please keep promoting club. Brochures and business cards are available if you need them. Here’s an idea? If you see a local ham license plate why not stick a club business card in their door?

I am sure many of you have creative ideas for promoting and/or improving the club and I would like to hear all of them.

Dan. KI6X, President
2020 Board of Directors:

President:
Dan Violette  KI6X  
(714) 637- 4632 
ki6x@w6ze.org

Vice President:
Tim Millard  N6TMT  
(714) 744-8909  
n6tmt@w6ze.org

Secretary:
Ken Konechy, W6HHC  
(714) 348-1636  
W6HHC@W6ZE.ORG

Treasurer:
Greg Bohning, W6ATB  
(714) 767-7617  
w6atb@w6ze.org

Membership:
Corey Miller  KE6YHX  
(714) 322-0395  
ke6yxh@w6ze.org

Activities:
Jim Schultz, AF6N  
(714) 544-5435  
af6n@w6ze.org

Publicity:
Vijay Anand, KM6IZO  
km6izo@w6ze.org

Technical:
Bob Eckweiler, AF6C  
(714) 639-5074  
af6c@w6ze.org

2020 Club Appointments:

W6ZE Club License Trustee:
Bob Eckweiler, AF6C  
(714) 639-5074  
af6c@w6ze.org

Club Historian(s):
Corey Miller KE6YHX  
(714) 639-5475  
ke6yxh@w6ze.org

Bob Evans, WB6IXN  
(714) 543-9111  
wb6ixn@w6ze.org

RF Editor for December:
Tom Cowart, W6ETC  
(714) 454-0571  
w6atb@w6ze.org

Webmaster:
Ken Konechy  W6HHC  
(714) 348-1636  
W6HHC@W6ZE.org

Assistant Webmaster:
Bob Eckweiler, AF6C  
(714) 639-5074  
af6c@w6ze.org

Tim Millard, N6TMT  
(714) 744-8909  
n6tmt@w6ze.org

ARRL Awards Appointees:
Arnie Shatz, N6HC  
(714) 573-2965  
N6HC@aol.com

John Schroeder, N6QQ  
(562) 404-1112  
N6QQ@msn.com

Monthly Events:

General Meeting time & location:  
Held third Friday of the month  
This month: AUCTION  
Begins at 7:00 PM held located at: 
The American Red Cross  
600 Parkcenter Drive  
Santa Ana, CA  
(Near Tustin Ave. & 4th St.)  
For more information see below.

Club Breakfast (Board Mtg) info:  
Held the First Saturday*  
of the month at 8am  
Marie Callender’s Restaurant  
307 E. Katella Ave  
Orange, CA 92867  
*Unless otherwise advised

Club Nets (Listen for W6ZE):

10M: 28.375 ± MHz SSB  
Wed- 7:30 PM - 8:30 PM  
Bob AF6C, Net Control  
Alt: Corey, KE6YHX, Net Control

2M: 146.55 MHz Simplex FM  
Wed- 8:30 PM - 9:00 PM  
Corey, KE6YHX, Net Control

75M 3.883 MHz LSB  
Wed ~9:15 PM  
Follows right after end of 2M Net  
Corey, KE6YHX, Net Control
CONGRATULATIONS TO THE ELECTED
2020 BOARD OF DIRECTORS

President
Dan Violette K16X
Vice President
Tim Millard N6TMT
Secretary
Ken Konechy W6HHC
Treasurer
Greg Bohning W6ATB
Activities
Jim Schultz, AF6N
Membership
Corey Miller KE6YHX
Public Relations
Vijay Anand KM6IZO
Technical
Bob Eckweiler AF6C
Director at Large
Tim Goeppinger, N6GP
Director at Large
Ron Mudry, W6WG
## A HISTORY of OCARC PRESIDENTS

by Ken Konechy W6HHC

with great assistance from our Club Historian Emeritus, Bob Evans - WB6IXN

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PRESIDENT</th>
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<tbody>
<tr>
<td>2020</td>
<td>KI6X Dan Violette</td>
</tr>
<tr>
<td>2019</td>
<td>KI6X Dan Violette</td>
</tr>
<tr>
<td>2018</td>
<td>N6GP Tim Goepinger</td>
</tr>
<tr>
<td>2017</td>
<td>N6GP Tim Goepinger</td>
</tr>
<tr>
<td>2016</td>
<td>AF6CF Nicholas Haban</td>
</tr>
<tr>
<td>2015</td>
<td>N6TMT Tim Millard</td>
</tr>
<tr>
<td>2014</td>
<td>AF6CF Nicholas Haban</td>
</tr>
<tr>
<td>2013</td>
<td>AF6CF Nicholas Haban</td>
</tr>
<tr>
<td>2012</td>
<td>W6GMU Paul Gussow</td>
</tr>
<tr>
<td>2011</td>
<td>W6GMU Paul Gussow</td>
</tr>
<tr>
<td>2010</td>
<td>K6PEQ Kristin Dankert</td>
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<tr>
<td>2009</td>
<td>AF6CF Nicholas Haban</td>
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<td>2008</td>
<td>N8WP Willie Peloquin</td>
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<td>2007</td>
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<td>2006</td>
<td>N8WP Willie Peloquin</td>
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<td>2005</td>
<td>W6HHC Ken Konechy</td>
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<td>2004</td>
<td>N1AB Steve Brody</td>
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<tr>
<td>2003</td>
<td>K6J5D Lowell Burnett</td>
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<tr>
<td>2002</td>
<td>K6WLU Cory Terando</td>
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<tr>
<td>2001</td>
<td>KD6BWH Bob Buss (later K6BWH)</td>
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<tr>
<td>2000</td>
<td>K6LDC Larry Hoffman</td>
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<tr>
<td>1999</td>
<td>WA6VPP Bud Barkhurst</td>
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<tr>
<td>1998</td>
<td>KD6BWH Bob Buss (later K6BWH)</td>
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<td>WA6VKZ Frank Smith</td>
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<td>1996</td>
<td>AF6C Bob Eckweiler</td>
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<td>N6XTJ Jim Roberts</td>
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<td>1992</td>
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<td>1991</td>
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<tr>
<td>2010</td>
<td>K6TXS Charles(Ed) Edwards</td>
</tr>
<tr>
<td>1959</td>
<td>W6BVI Ken Kesel</td>
</tr>
<tr>
<td>1958</td>
<td>W6BVI Ken Kesel</td>
</tr>
<tr>
<td>1957</td>
<td>- CLUB DISBANDED -</td>
</tr>
<tr>
<td>1956</td>
<td>W6HIL Bob Swenson</td>
</tr>
<tr>
<td>1955</td>
<td>W6BVI Ken Kesel</td>
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<tr>
<td>1954</td>
<td>W6UPP Marinus Conway</td>
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<tr>
<td>1953</td>
<td>Probably only informal meetings, no officers?</td>
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<tr>
<td>1952</td>
<td>W6QZQ Horace Bates</td>
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<tr>
<td>1951</td>
<td>W6LDJ Sam (Mac) McNeal</td>
</tr>
<tr>
<td>1950</td>
<td>Probably only informal meetings, no officers?</td>
</tr>
<tr>
<td>1949</td>
<td>W6CGF Chuck Lunder</td>
</tr>
<tr>
<td>1948</td>
<td>W6BWO Dale Boss</td>
</tr>
<tr>
<td>1947</td>
<td>W6ALO Tommy Gentges</td>
</tr>
<tr>
<td>1946</td>
<td>W6DEY Roy Maxson</td>
</tr>
<tr>
<td>1945</td>
<td>W6DEY Roy Maxson</td>
</tr>
<tr>
<td>1944</td>
<td>- ALL OFF TO WAR!!</td>
</tr>
<tr>
<td>1943</td>
<td>- ALL OFF TO WAR!!</td>
</tr>
<tr>
<td>1942</td>
<td>W6iBN Roy Cumpston</td>
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<tr>
<td>1941</td>
<td>W6BAM Shelley Trotter</td>
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<tr>
<td>1940</td>
<td>W6KLU Harold Christensen</td>
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<tr>
<td>1939</td>
<td>Probably only informal meetings, no officers?</td>
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<tr>
<td>1938</td>
<td>W6NSA Les Gates</td>
</tr>
<tr>
<td>1938</td>
<td>W6ADT Noral Evans</td>
</tr>
<tr>
<td>1937</td>
<td>W6LYN Noral Evans</td>
</tr>
<tr>
<td>1936</td>
<td>W6LYN Noral Evans</td>
</tr>
<tr>
<td>1935</td>
<td>- CLUB DISBANDED!!</td>
</tr>
<tr>
<td>1934</td>
<td>W6IGO Earl Moore</td>
</tr>
<tr>
<td>1933</td>
<td>W6IGO Earl Moore</td>
</tr>
</tbody>
</table>

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2020 NEW or RENEW ANNUAL DUES are DUE!

Go ONLINE to: http://www.w6ze.org/MemberForms/Join RenewForm.html#2/40

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January 2020 – OCARC RF Newsletter – Page 4
Auction

Buy Used (& New) RADIO & ELECTRONIC GEAR and ACCESSORIES. Bring your gear* to sell.

DATE:

January 17th, 2020

7:00PM Auction starts promptly
6:00PM Registration and equipment check-in at the American Red Cross

“George M. Chitty’ Bldg.”
600 Parkcenter Drive, Santa Ana, CA

* SPECIAL NOTE: Radio and Electronic Gear ONLY

The room will open at 6:00 PM to allow registration, set-up and viewing.

Buyers and sellers are welcome provided they follow established guidelines:

1. Only Ham radio or electronic equipment / items will be allowed.
2. You must register prior to or at the auction site the day of the auction when doors open.
3. Sellers should number each item in their lot. A tag should indicate the minimum bid they expect.
4. Only 3 items from a Sellers lot will be auctioned during each turn and then the auctioneer will move on to the next lot.
   Once the other lots lot have been offered the auctioneer will start the second round of auctioning with the next 3 items in Lots.
5. Auction bidding will take place as follows:
   (a) $0.00-to-$5.00 bidding will take place in $0.50 increments.
   (b) Over-$5.00-to-$50.00 bidding will take place in $1.00 increments.
   (c) Over-$50.00-to-$100.00 bidding will take place in $5.00 increments.
   (d) Over-$100.00 bidding will be in $10.00 increments.
6. Rules 4 and 5 may be changed at the auctioneer’s discretion to expedite the auction.
7. Payments for purchased items are due at the end of the auction and shall be by cash or check with the appropriate ID. No two-party checks or credit cards are allowed. Disbursements to the Sellers will be by OCARC check only.
8. ALL Sellers will be charged 10% of the selling price for items sold by OCARC. A special table will be set up for items donated to the OCARC and proceeds from the sale of donated items will go into OCARC operational funds.

by Tom W6ETC
IMPORTANT

NEW AUCTION INFO NEW FOR 2020
SELLERS PLEASE NOTE!

• IF YOU ARE SELLING ITEMS? >>> Before the Auction: Please prepare in advance on a separate sheet of paper the DESCRIPTIONS of each item and the minimum (opening) bid $amount if any you are requesting? If no one is willing to bid the minimum amount you will be asked during the auction if you will accept a lower bid. This will be used by the Auctioneer during the AUCTION.
  o Please indicate if the device works or not and any important info regarding its condition?

• DONATE YOUR EQUIPMENT TO THE CLUB: Proceeds from club donated equipment will help to offset administrative costs to OCARC throughout the year. A completed transaction is required before the OCARC can accept the donation and gain benefit from your donation. It will be very helpful if you also include a listing describing the items you are donating. Thank you for your donation.

• At the END of the AUCTION:
  o ‘Buyers’ will go first in line. After BUYERS transactions have been completed then
  o SELLERS* can line up for payment following all BUYER transactions. See note below!

• *SELLERS - save time! You can request to have the auction proceeds sent to you by check instead of having to wait in line following the AUCTION. Please advise upon check-in with AUCTION administrators and bring an SASE (Self-addressed & stamped envelope).

PARTIAL LIST AUCTION ITEMS

- Ten-Tec "Jupiter" HF rig 100 W
- Ten-Tec 708 Desktop Microphone
- Johnson Match-Box antenna tuner
- SONY FM-AM Stereo Receiver Model STR-DE595 - left speaker channels not working.
- Pioneer PD-7030 Front-Loading CD Player - malfunctioning.
- Large Black Plastic Printer Cartridge NEW (laser printer?), unknown make and model.
- Assorted Electronic Parts and Components including many untested High-Voltage Capacitors.
- LDG AT-100Proll Auto-Tuner Antenna tuner
- MFJ 969 Antenna tuner
- 30M shortened-vertical-dipole (home-designed, 12-ft length designed to radiate Omni)
- MAHA universal battery charger
- 144/440 MHz whip antenna for Baofeng and Wouxun handhelds - 15.6 inch model NA-771 with SMA connector
- ICOM SM20 mic
- A complete portable analog amateur television station less camera etc. built by WA6PFA Elmer Thomas. This has been used on FD for many years. It’s all built into a fancy aluminum box
- A portable amateur TV transmitter. Built by WA6PFA
- Power supply 12V & 5 -18 volts adjustable. Built by WA6PFA
- Magellan GPS 315
- Magellan GPS Explorist 300
- Heathkit uMATIC Memory Keyer, model SA-5010
- J.W. Miller Automatic Antenna Tuner, model AT 2500
- Robot Specialty Mode RTTY Terminal, model 800
- LED samples Kit of few hundred LED colors & types, by Stanley
- Electro-Voice model 619 dynamic microphone
- Archer Coax Switch
- Knight microphone audio compressor, model C-577
- Kenwood UHF commercial transceiver setup on the UHF repeater ham band, model TK-8150. Output power is 45 watts
- Kenwood UHF commercial transceiver setup on the UHF repeater ham band, model TK-8150. This unit includes the Remote Mount Kit.
- Heathkit model VL-1180 VHF amplifier
- Hewlett Packard 204C Oscillator
- Intronics ‘The Pocket Programmer 2
- Tech-Tools ER3 EPROM Emulator

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**FRIDAY JANUARY 17TH**

**7 PM**

**AMERICAN RED CROSS**

*Mark your calendars for the January 17th, 2020*

**O.C.A.R.C. AUCTION**

*Do I Hear $15? SOLD*
COME JOIN US FOR
WINTER FIELD DAY
2020

2020 Winter Field Day will begin on
Saturday, January 25th
and ends on
Sunday, January 26th

Ocean View School District site located at
17200 Pinehurst Lane in Huntington Beach

ORANGE COUNTY AMATEUR RADIO CLUB W6ZE

For more information go to www.W6ZE.org

by W6ETC
“2020 Winter Field Day”
January 25th and 26th 2020
Contest period run from...
Saturday 1900 UTC to Sunday 1900 UTC

The event will be held at:
Ocean View School District site located at
17200 Pinehurst Lane in Huntington Beach.

Multiple operating positions with bands and modes for everyone.*
Bands: 160m, 80m, 40m, 20m, 15m, 10m, 6m, 2m plus UHF and VHF bands
Possible Modes include: SSB, CW, and Digital, Satellite

If you plan on coming please let me know.
If you like more information please contact
Ron W6WG@W6ZE.ORG
WFD Coordinator

*Note: Operating positions and bands of choice are subject to change without notice.
January

- **Straight Key Night:** 0000Z – 2359Z January 1
- **ARRL RTTY Roundup:** 1800Z Saturday January 4 to 2400Z Sunday January 5.
- **ARRL Kids Day:** 1800Z – 2359Z Sat. January 4
- **ARRL January VHF Contest:** 1900 UTC Saturday Jan 18 to 0359 UTC Mon. January 20.
- **CQ 160 Meter Contest / CW:** 2200Z Saturday 25 Friday to 2159Z Sunday January 27.

February

- **10-10 Winter Contest, SSB:** 0001 UTC through 2359 Sunday Feb. 2
- **North American Sprint / CW:** 0000 UTC through 0400 Sunday Feb. 2
- **CQ WW WPX / RTTY:** 0000 UTC Saturday Feb. 8 through 2359 UTC Sunday Feb. 9
- **ARRL International DX Contest:** CW: 0000 UTC Sat. Feb. 15 through 2400 UTC Sunday February 16
- **CQ WW 160 Meter SSB:** 2200 UTC Friday Feb. 21 through 2200 UTC Sunday February 23
- **North American QSO Party / RTTY:** 1800 UTC Feb. 29 through 0559 Sunday March 1

Repeating Activities:

- **Phone Fray:** Every Tuesday night at 0230Z to 0300Z.
- **CWops Mini-CWT:** Every Wednesday at 1300 to1400 UTC, 1900-2000 UTD and Thursday 0300-0400 UTC.
- **SKCC:** Weekend Sprintathon (Straight Key CW) on the first weekend of the month after the 6th of the month. 1200 Sat. to 2359Z Sunday.
- **SKCC:** Sprint (Straight Key CW) 0000Z to 0200Z on the 4th Tuesday night (USA) of the month.

* Indicates club entries are accepted
** Indicates team entries are accepted

Note: When submitting logs for ARRL Contests indicate your club affiliation as “Orange County ARC”

Do you have a favorite Amateur radio event or activity you’d like added to this list?

Just send an email to Ron W6WG, w6wg@w6ze.org with your request. Include information and links and/or background information to be considered for inclusion into the next month’s Radio Activities column.

73, Ron W6WG
Orange Police Dept. **RACES** is looking for hams to volunteer during Baker-2-Vegas foot race. Each spring, law enforcement running teams (from around the world) have entered in a competitive foot-relay-race through the desert. This race, known as “Baker-to-Vegas” (and aka B2V), is a 120 mile long race, that starts outside Baker (CA), runs through the desert to Shoshone, then runs through Pahrump, NV and finishes at the Rio Hotel in Las Vegas. The runners of the Orange Police Department have been supported for many years with communications by Hams belonging to COAR (City of Orange Amateur Radio) RACES and OCARC members.

The B2V race this year occurs on Saturday, April 4 & Sunday, April 5, 2020. COAR RACES is looking for a few more hams who are willing to help with communications during the Baker-2-Vegas race.

If interested, please contact Will Stoddard KJ6IA (Orange COAR RACES Radio Officer) at willst64@Gmail.com or Ken W6HHC at W6HHC@W6ZE.org for more information.

Ken
W6HHC

**Family Time at Sequoia National Park**

*by Dan KI6X*

Here’s a positive example of the camaraderie that Amateur Radio Operators demonstrate when they meet other Amateur Radio Op’s.

While my family and I were vacationing in the Sequoia National Park a fellow Amateur Radio Operator Aki (JA5DQH/KH7A) spotted my license plate and just had to come over and say Hello in one of the parking lots!

This resulted in a friendly exchange of information and quick conversation regarding our Amateur Radio adventures and the beauty of the Sequoia National Park. I looked after getting home that I had worked him from Japan in two different CQWW CW contests. The chance meeting and a friendly contact made the trip extra special.
The OCARC Board meeting was held at the Marie Calendar’s Restaurant at 307 E Katella Ave. in Orange on Saturday Jan 4, 2020 at the 8:07 AM. In attendance were 9 members. All of the directors, except Bob AF6C and Greg W6ATB, were present for a Board quorum.

Director Reports:
• Membership – Corey KE6YHX reported the club membership currently has 110 members.

Old Business:
• Newspaper Editors
  Jan – Tom W6ETC (this edition)
  Feb – Vijay KM6IZO
  Mar – Tim N6GP
  Apr – Nicholas AF6CF
  May – Jim AF6N

General Meeting Programs
• The OCARC Radio Auction
• Pitcairn DXpedition by Arnie N6HC
• To Be Determined

• By-Laws Update Committee
Tim N6GP explained that a clean and updated revised set of by-laws would be sent out to the board for review. There was a discussion of possible changes to the details of the “officer election process”. The current plan is to hold a first reading of the updated Bylaws for the club membership at the February 2020 general meeting.

• Financial Audit Committee
The OCARC treasurer, Greg W6ATB, has delayed the audit of 2019 finances until February.

New Business:
• Donation to Red Cross
In recognition of providing the OCARC with a meeting place for the last 25 years, the Board approved a motion to make a donation of $250 to the Red Cross general fund for disaster aid.

• Update to OCARC Trifold Brochure
The urgency is gone now that we discovered about 250 existing brochures. Work will continue to update the existing brochure…especially changes to the club nets.

• Location for next OCARC Christmas Dinner
With the approval of the Board, Jim AF6N is going to make reservations for the next OCARC Christmas Dinner to be held in the “larger room” at Mimi’s Café on 17th Street.

Good of the Club:
• WB6IXN
Corey KE6YHX reported that Bob Evans WB6IXN is getting settled in Talent, Oregon. Bob WB6IXN says “hi to all OCARC members”.

• Ring Security
Ken W6HHC started a discussion on RING Security Systems.

Submitted by Ken W6HHC, OCARC Secretary
## OCARC Cash Flow YTD

**1/1/2019 through 12/31/2019**

### INFLOWS

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<thead>
<tr>
<th>Category</th>
<th>1/1/2019-12/31/2019</th>
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<tbody>
<tr>
<td>Antenna Kit INCOME</td>
<td>60.00</td>
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<td>ARRL FD 2019 T-shirts</td>
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<tr>
<td>ARRL Membership Dues</td>
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<td>Badge Income</td>
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<td>Food Snacks Donations</td>
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<td>Petty Cash Acct Return</td>
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<td>RAFFLE PROCEEDS</td>
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<td>Raffle Reg Income</td>
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<tr>
<td>Refreshments Income</td>
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<td>Rodrigo's Dinner Meeting</td>
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### OUTFLOWS

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**OVERALL TOTAL**                              | **-443.89**         |
Heathkit of the Month (HotM) #97:
by Bob Eckweiler, AF6C

AMATEUR RADIO - SWL
Heathkit SA-2040
Antenna Tuner

Introduction:
In the second half of 1979 Heathkit released
the SA-2040, a no-frills, full legal-limit, anten-
tenna tuner (Figure 1). Heath’s previous anten-
tenna tuner, the AC-11 first appeared in a
Heathkit ad in the September 1953 issue of
Radio News. The AC-1 continued to be sold
until the AT-1 transmitter was replaced by
the DX-20 HF CW transmitter in late 1956.

In the 1950s a revolution in ham equipment
began. The new rugged 6146 transmitting
tube became popular along with the pi-net-
work output circuit designed for 50 - 75Ω
coaxial cable. Coax became the feedline of
choice due to its ease of use, and 50 and 75Ω
resonant antennas became very popular. A
well designed pi-network could tune a load
with an SWR of up to 3 to 1 allowing reason-
able bandwidth around the resonant fre-
quency. The average ham shack no longer
needed an antenna tuner. For those still us-
ing non-resonant wire antennas the venerable
E.F. Johnson Matchbox tuner line was widely
available. Over this period few antenna
tuners were marketed in the ham magazines,
though construction articles appeared occa-
sionally, and many users of wire antennas
home-brewed their tuners. In the 70’s, as
newer radios came on the market, many using
less rugged TV sweep tubes and others using
easily damaged RF power transistors with
their broad-band output coupling, antenna
tuners quickly entered back into the vogue.

Heathkit reentered the antenna tuner mar-
et with the SA-2040 antenna tuner. The
SA-2040 originally sold for $149.95, a price it
held for about two years during an inflation-
ary period. By the fall of 1981 the price rose
to $154.95 and by the winter of 1982/1983 it
reached $169.95. It was no longer offered in
the fall 1983 catalog.

Heathkit offered two other full legal-limit
antenna tuners, the SA-2060 (followed by an
‘A’ version) and the SA-2500 automatic
tuner. The original SA-2060 was offered
starting in 1981 and sold alongside the
SA-2040 for a couple of years. These tuners
may be covered in a future HotM article.

The Heathkit SA-2040:
While the SA-2040 has been referred to as a
basic no-frills tuner, this is not in reference
to its matching capability. What it lacks are
the capabilities that are easily handled ex-
ternally, such as SWR measurement and anten-
na switching. The SA-2040 is a clone of
Lewis McCoy-W1ICP’s Ultimate Transmatch2.
The SA-2040 is capable of tuning into loads
with an SWR as high as 10:13, though Heath

1. Notes appear at the end of this article.

Here is a link to the index of Heathkit of the
Month (HotM) articles:
http://www.w6ze.org/Heathkit/Heathkit_Index.html
specified its matching output impedance only as “wide-range”. Specifications are shown in Table I.

The SA-2040 has a 50Ω input and has outputs for a coaxial cable connected antenna, a single wire non-resonance antenna and a balanced-feedline antenna. This last output is coupled via an internal 1:4 toroidal balun transformer. Only one antenna at a time should be connected to the multiple outputs.

The SA-2040 measures approximately 5½” H x 14¾” W x 14” D and weighs 10⅝ lbs. Internally it has only four electronic components: two large high-voltage variable capacitors, a roller inductor and a balun coil. They are liberally spaced apart due to the high RF voltages that can be present in the tuner. Both capacitor rotors are at a high RF potential so the extension shafts are made of insulating material. The input capacitor has two sections, each section is 125 pF. This is not a differential capacitor; the sections track with the same capacitance. The rear stator section on this capacitor is directly grounded by the mounting feet. The rotor section and remaining stator section are isolated from ground by ceramic end-plates. The output capacitor has a single 170 pF section with both the rotor and stator sections isolated from ground by ceramic end-plates. The roller inductor is 12 µH. The hot end is the rear shaft. The front cold end, the roller contact and its shaft and tensioners are grounded.

The front panel is bare aluminum covered with a self-adhesive-backed sheet of “vinylite” that contains the panel markings. This panel is medium-dark gray with black trim and black and white lettering. It includes a window to allow viewing the turns-counter. There is also an erasable table area where one may mark down settings for later reference as well as a place to put the station call-letters using supplied vinyl lettering. This area is shown in figure 2. The cabinet is painted black, and the rear panel is painted a light gray with black lettering.

The SA-2040 Controls and Connections:

The front panel of the SA-2040 has three large control knobs. On the left, TRANSMITTER MATCHING adjusts the dual-section input capacitor. The dial is marked 0 - 100 in 5 unit increments over 180°; every other increment is numbered. In the center, INDUCTOR controls the roller inductor. It has no dial markings, but to the left of its knob is the window of a turns-counting dial. Every full turn of the inductor is represented by 10 counts on the dial. The inductor has about 25 turns or 250 counts. On the right, ANTENNA
MATCHING adjusts the output capacitor and is marked in a similar manner as the TRANSMITTER MATCHING control.

The input and outputs are all located on the rear panel (Figure 3). Viewed from the rear, (left to right) are: a ground terminal with a wing nut; two large ceramic feedthrough insulators (J5 and J4) for a parallel feedline; a large ceramic feedthrough insulator (J3) for a single-wire antenna; a UHF coax connector (J2) for a coaxial antenna; and finally another UHF coax connector (J1), for the input from the transmitter. A large space is left between J1 and J2 to help prevent them from being mixed-up. When using a parallel feedline a connecting strap must be connected between the middle and right ceramic feedthrough insulators (J4 and J3). This strap may be stored across J5 and J4 when not using a parallel feedline. Wing nuts are used on these insulators to expedite secure connections.

The SA-2040 Construction:
Heathkit refers to the SA-2040 assembly as a “two evening project”. After the parts are checked assembly begins. Here is where you get a surprise. No need to fire up the soldering iron yet, first you have to assemble the two large variable capacitors and the continuously variable inductor. Then the balun toroids must be prepared and wound. Finally you’ll be heating the iron to tin the balun leads and solder on a pair of screw lugs.

ANTENNA MATCHING Capacitor Assembly:
First the ANTENNA MATCHING capacitor C2 is built. The rotor section, (Figure 4) assembles with a hex shaft, two control nuts, nineteen 17/64” spacers and eighteen rotor plates.

Next, the front capacitor plate is assembled by adding two ceramic insulators to the metal front plate using four #8 screws and eight fiber washers. Then the stator assembly (Figure 5) is built using two 6¾” #10-32 threaded rods, four large fiber washers, eight nuts, four 3/16” spacers, thirty-two 17/64” spacers, seventeen stator plates and the previously assembled front plate. The rotor and stator sections are then mated adding conical and forked springs, and lubrication is applied using grease supplied with the kit. Next, the capacitor rear plate is assembled, in a similar fashion to the front plate, and installed. Finally a knob is temporarily installed on the capacitor shaft and nuts are adjusted so the stator plates are centered between the rotor plates (Figure 6). Rotational tension is adjusted as necessary, the knob is removed, and C2 is set aside. The assembly of C2 takes up five pages in the manual and a full page in the
separate large illustration booklet using four pictorial, four detail and three inset drawings.

**TRANSMITTER MATCHING Capacitor Ass’y:**
The dual-section TRANSMITTER MATCHING capacitor C1 (Figure 7) is assembled next. Its assembly is a bit more complicated since there are two separate stator sections. The C1 assembly also takes up five manual pages as well as two pages in the illustration booklet.

**Roller INDUCTOR Assembly:**
The continuously variable rotary inductor L1 is then assembled. The silver-plated inductor comes mounted on a ceramic drum with shafts attached. End plates and the roller contact mechanism are assembled around the rotor inductor. Assembly of L1 takes four pages in the manual and another page in the illustration book.

**Balun Transformer Assembly:**
The balun transformer T1 uses two large toroidal cores. Before winding the coil, each core is separately insulated with supplied glass-cloth tape, and then the two cores are placed atop each other and tape is wound around both cores along the full circumference. An eleven foot length of heavy stranded teflon-insulated wire is doubled over at its center and wound onto the toroid to create fifteen bifilar turns. A two-foot length of glass-cloth tape is then wound around the circumference of the coil to hold the windings in place. The doubled wire is cut apart, and the four wire ends are trimmed to length and tinned. Using an ohmmeter, the winding
leads are identified and marked with tape (Figure 9). The tape is placed on one winding at the starting end and on the other winding at the finished end. #10 lugs are then soldered on the two untaped leads. A ceramic feedthrough is used unconventionally to make a mounting post for the balun (Figure 10). Assembling the balun transformer T1 takes five pages in the manual.

Chassis Assembly:
Once the two capacitors, roller inductor and balun are assembled, chassis assembly is started. The turns counter is assembled and mounted, the front panel “vinylite” face is mounted to the front panel, shaft bushings are installed for the three front panel controls, and the shaft with nylon gear is installed on the turns-counter shaft. On the rear panel the two UHF connectors, three large feedthrough insulators and grounding bolt with wing nut are mounted. The balun T1 is mounted next. The two taped leads are soldered to a ground lug on the inside of the chassis at the grounding bolt, and the two remaining leads are attached to feedthroughs. The roller inductor, and two variable capacitors are aligned with and mounted to the chassis and attached to insulated shafts that fit through the bushings on the front panel. A beveled nylon gear is first mounted on the inductive shaft that meshes with the gear on the turns-counter shaft. The turns-counter is calibrated and the gears are tightened.

Chassis Wiring:
Wiring the components together is done by straps and short lengths of #10 bare wire. Two silver-plated straps are used. One connects L1 to C1 and C2; the second connects C2 to the J3 feedthrough. A short piece of #10 wire connects J1 to a lug that bolts to
C1; another short piece of #10 wire connects J2 to a lug that bolts to J3.

This completes the soldering. In all four leads were tinned, four solder lugs were soldered to the ends of those wires and three other soldering connections were made.

**Final Assembly:**
After the “Blue Label” that contains the kit’s model and series numbers is attached to the inside rear of the chassis, the feet are installed. Heathkit offers a choice of the kit sitting flat or tilted at an angle by adding extensions to the two front feet. Knobs are attached, and after a thorough inspection the cabinet is attached using eight black machine screws.

**SA-2040 Circuit:**
The SA-2040 circuit diagram is shown in Figure 14 at the end of the article. It is one of two popular design derivatives of the Tee-matching network (Tee-Transmatch). The basic Tee-Transmatch network is shown in Figure 10A. It does a good job of matching even very high SWR loads (The W8ZR antenna tuner can match up to an SWR of 16:1). What it lacks is good harmonic attenuation, especially if improperly tuned. Figure 10B is a modification of the Tee-Transmatch called the Ultimate Transmatch previously mentioned. It adds another section to the input variable capacitor to ground and was said to have better harmonic suppression. Later it was found that the extra capacitor added little if any performance advantage. An “improved circuit”, called the SPC network, “because the word ‘ultimate’ had already been used”, is shown in Figure 10C. SPC stands for “series, parallel capacitance”. The SPC did do a better job of harmonic suppression and was described in the ARRL Handbook for many years. It did have two drawbacks, the first being the tuning was
very sharp, especially on the lower bands, and a vernier knob on the capacitors was needed to ease tuning. The second drawback turned out to be the one that killed the SPC design. It was found to be significantly more lossy than the other two. Heathkit never used the SPC circuit; the SA-2040 uses the Ultimate Transmatch circuit and the later SA-2060(A) and SA-2500 both use the Tee-Transmatch circuit. Not shown in the Figures 10 is the balun often found in these tuners. It is shown in Figure 11.

**Using the SA-2040:**

Setting the three controls on the tuner properly is important. It is possible to get a low SWR at more than one setting, but the wrong setting will reduce harmonic suppression, be less efficient and can cause arcing across the tuning capacitors due to excessively high voltage. To properly tune-up using the SA-2040, and most other antenna tuners, an SWR bridge, placed between the transmitter and antenna tuner is needed. Fancier tuners, such as the SA-2060(A), have this capability built in. When using an external SWR bridge it should be dedicated to the tuner if the setup will be used on a day to day basis. Short lengths of 50Ω coax should be used to connect between the transmitter, SWR bridge and SA-2040.

In Lew McCoy’s article, that introduced the circuit used in the SA-2040(A), he gave basic adjustment instructions, here is the author’s interpretation:

1. Start with C1 and C2 at maximum capacitance (fully CCW), and L1 at maximum inductance for 80/75 meters, about half inductance for 40/30 meters, about quarter inductance for 20/17 and about eighth inductance for 15/12/10 meters.
2. Apply just enough power to get a full-scale reading in the forward direction on the SWR bridge.
3. Set the bridge to read reflective power, and slowly adjust L1. At some point the reflected power will dip sharply; adjust for a minimum.
4. Now adjust C1 and C2, and touch-up L1 for a perfect match.
5. Now you may increase power to the level desired. You may want to touch-up the settings at the higher power.
6. If you change frequency check the match, and touch-up C1, C2 and L1 to correct the match if needed.
7. More than one match often is encountered. Always select the match that uses the highest capacitance settings.
To aid initial operation, Heathkit provided a table of starting points for the initial settings for 80 through 10 meters (non-WARC bands only). For each band, settings are given for the low and high end of the band and a third around mid-band. This table may be found in the manual.

Make note of your settings for each antenna you use so you can make adjustments quickly when making large frequency excursions or changing bands. Note that things like moisture and obstacles can cause you to have to adjust your settings somewhat. Sudden major changes warrant a physical check of the antenna before transmitting at high power.

**Comments:**
Today many solid-state radios come with some sort of antenna tuner built-in or available as an accessory that mounts internally. These tuners generally provide only a coaxial output. They help match the transmitter to an antenna that is resonant at one frequency in the band by making the antenna capable of being resonant across the whole band, or in the case of 80/75 meters across a larger part of the band.

If you are using a non-resonant antenna such as a long-wire or end fed antenna, or an antenna fed by parallel feed (such as twin-lead) then a full-fledged antenna tuner such as the SA-2040 is recommended.

**From the Author:**
Suggestions are always appreciated for kits of interest to research and write about. April will soon be upon us and, as some know, I often try to pick an unusual kit to write about in celebration of April Fool’s Day. Suggestions for April are also welcome, though I believe I have found an unusual one for 2020. Due to the holidays I probably won’t have an article for January, which could make the April article #100.

In HotM #95 I wrote about the A-1 Audio Amplifier, the first hi-fi kit offered by Heathkit. I’m still looking for any documentation...
anyone has on that kit. I have not found the original schematic, though one dated August 18, 1948 is on the web. Unfortunately this turns out to be a schematic later released by Heathkit so users could upgrade their A-1 to the A-2. That schematic uses a 6SL7 preamplifier tube while the original uses a 6SN7. If you have an A-1 or the documentation, please contact me. You may email me by clicking on the link at the bottom of the copyright box.

73, from AF6C

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Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.

Thanks - AF6C

NOTE: This article was originally written to appear in the December 2019 issue of RF but was held until January of 2020 due to circumstances beyond the control of the author.
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(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).