



RF



ORANGE COUNTY AMATEUR RADIO CLUB, INC.

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December 2018

The Prez Sez.....

by Tim N6GP



Normally, things are winding down at this time, but I have a lot of news. First, I want to report on our excellent Christmas party at Mimi's Café. It was well attended, and I know everyone enjoyed themselves. A big thank you goes to Ron Mudry and the Board for planning the event. Congratulations to prize winners.

It was an honor to surprise Ken W6HHC and Bob AF6C with Lifetime Achievement Awards. This is a small token of appreciation for the 5 decades of service that each of them has made to our club. The contributions they have made to our club have been great, and they helped our club through

some very lean years about 20 years ago. Our 85 years as a club is a testament to their dedication.

Jim Schultz, AF6N, was awarded the Good Of the Club award for his excellent work on the Board in 2018. In addition to doing a fine job with his duties as club Secretary, he was always willing to volunteer for special projects. Not the least of these was his shepherding of the 85th anniversary mugs. He spent a lot of time and his own money developing these mugs, and we really enjoy them. Thanks for a everything you have done, Jim!

Lots of news from the ARRL. The Field Day scores are out, and we finished in 19th place out of 2900! Thanks again to our great FD team, including ABCD ops! Remember, Winter Field day is a month away!

This is the last of 24 Prez Sez columns that I've written. It has been an honor to serve you as President for 2 years, and our Board made the job an easy one. I have passed the Presidential gavel to my friend Dan Violette KI6X, and I am confident that he will be a great President.

Tim Goeppinger N6GP, Pres

Next General Meeting

The January 18th 2019 OCARC General Meeting program will be presented by Arnie Shatz, N6HC...

"Baker Island DXpedition"



The next General Meeting will be on:

Friday, January 18, 2019

ENTER from the WEST SIDE entrance of the
Red Cross Building, Room 208
Take elevator to the 2nd Floor.
See you there!

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2018 Board of Directors:

President:

Tim Goeppinger N6GP
(714) 730-0395
N6GP@w6ze.org

Vice President:

Dan Violette
KI6X@w6ze.org

Secretary:

Jim Schultz AF6N
(714) 544-5435
AF6N@w6ze.org

Treasurer:

Ken Konechy, W6HHC
(714) 348-1636
W6HHC@w6ze.org

Membership:

Bob Eckweiler AF6C
(714) 639-5074
AF6C@w6ze.org

Activities:

Ron Mudry W6WG
(714) 840-3613
W6WG@w6ze.org

Publicity:

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

Technical:

Kenan Reilly KR6J
(714) 277-8798
KR6J@w6ze.org

Directors-At-Large:

Clem Brzoznowski, WØMEC
(714) 927-4065
WØMEC@w6ze.org

Corey Miller KE6YHX
(714) 639-5475
KE6YHX@w6ze.org

2018 Club Appointments:

W6ZE Club License Trustee:

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

Club Historian(s)

Corey Miller KE6YHX
(714) 639-5475
KE6YHX@w6ze.org

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

RF Editor for December:

Dan Violette KI6X
KI6X@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
(West Orange Co.)
(562) 404-1112
n6qq@msn.com

Contact the Newsletter:

Feedback & Corrections:
rf_feedback@w6ze.org

Submit articles:

editors@w6ze.org

Monthly Events:

General Meeting:

Third Friday of the month
at 7:00 PM held at:
American Red Cross
600 Parkcenter Drive
Santa Ana, CA
(Near Tustin Ave. & 4th St.)

Club Breakfast (Board Mtg):

Normally First Saturday of month at 8am
Marie Callender's Restaurant
1821 North Grand Ave
Santa Ana, CA
(Between 17th & Santa Clara)

Club Nets (Listen for W6ZE):

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

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

7.086 ± MHz CW **OCWN**
Sun- 9:00 AM – 10 AM
Ann K6OIO, Net Control



Club Dues for 2018:

Regular Members renewals* - - - \$30
Family renewal/Join** - - - - - \$45
New Member Join Nov-Dec*** \$30
Replacement Badge**** - - - - - \$ 3

* Member renewals Jan-Dec.

** Two members or more, w/badge.

*** New members Nov thru 2019 w/badge.

**** There is a \$1.50 charge if you'd like to have your badge mailed to you.

More News From Tim Goeppinger N6GP, President

The results are in from the ARRL Director elections, and I am pleased to report that 4 of the 5 "transparency" reform candidates won. Now our SW Div. Director, Dick Norton N6AA, has an 8-7 majority on the ARRL Board.

It has been a busy month with the rather new mode FT8 also. The new 2.0 version of WSJT-X was officially released Dec 10th, and you need to upgrade now if you haven't yet. The new version is not compatible with the old versions (v 1.x.x) and there are many features added to implement contest operations. 1,250 hams competed in the first ever FT8 contest this month and gave the new version a real test in a contest situation.

HOLIDAY DINNER PICTURES



Jim-AF6N (R) accepts the 2018 Good-Of-The-Club Award from President Tim N6GP for his enthusiasm and energy working on club projects. The "Good of the Club Award" is presented annually to the OCARC club member who has made the most significant contribution to the club for the year. In 1997, this annual award was then dedicated to the memory of Kei Yamachika - W6NGO, for his year-after-year contributions in support of our club's activities.



Plaques for our Lifetime Achievement Award winners (biographies in this RF).

The award is given to a member that has given long time outstanding service to OCARC. This award is only given when there is a deserving person(s) and not on a scheduled basis.



Our outgoing President, Tim N6GP (center), with our recent Lifetime Achievement Award winners, Bob AF6C (l) and Ken W6HHC (r). Congratulations and thanks for the years of outstanding service.



Our outgoing President, Tim N6GP (l), receiving a plaque for his last two years of great leadership to OCARC as our President. This is being given by Dan KI6X, the Vice-President.

The prize pool at the banquet. Notice the consolation prize. Appreciate the donation from Nicholas, AF6CF. It was an antique "unit" which had a great look (not sure it functioned though).





Enjoy the banquet attendees' photos and find yourself or your friends having a great time.





UP COMING EVENTS

January 18th, 2019

Arnie Shatz, N6HC

“Baker Island DXPedition”

Photos and discussion of the recent Baker Island, KH1/KH7Z, DXPedition. Arnie was the medical representative along with all the other duties of preparation, set-up, operating, and tear-down. , Arnie always brings back interesting presentations from his trips.

February 15th, 2019

Doug Millar, K6JEY

“10 GHz EME”

EME = Earth-Moon-Earth

March 15th, 2019

William Phinizy, K6WHP

Dave Martin, KD6QIY

“Civil Air Patrol (CAP)”

For the most current Upcoming event information go to the OCARC EVENTS website:

<http://www.w6ze.org/Events.htm>

Opportunity Drawing Request:

If you have something you would like to part with, donate it before the meeting for the Opportunity Drawing.

See Ron W6WG



OLD QSTs AVAILABLE - Ralph Houseman, WB6HHA (714) 695-0425 has a collection of QST Magazines going back to 1960 that need a good home. He is located in Yorba Linda. Libraries do not want and don't want to see in trash.

LIFETIME ACHIEVEMENT AWARD BIOGRAPHY

Bob Eckweiler, AF6C

Bob was born in Manhattan, NY in the mid-forties. His parents lived in Elmhurst, on Long Island at the time. They moved to Manhasset, L.I. a few years later. Bob's dad was a former ham - 2CXX around 1925 but left the hobby to follow a career in mathematics and physics.

Bob's ham career started in Junior High in Manhasset NY in 1959 as WV2GUQ thanks to W2CJY, his Elmer. He upgraded to General in a year receiving a WA2 prefix. He took several years off from radio while attending Penn State.

Bob moved to California in 1965, finished at Cal State Long Beach with a degree in Physics. The move resulted in a new callsign being issued: WB6QNU.

Bob went to work at Douglas Aircraft in Flight & Laboratory Test in June of 1968 designing specialized instrumentation for structural and wind tunnel testing. He spent his whole career at McDonnell Douglas which later became Boeing.

He upgraded to Advanced Class in July of 1969 due to the incentive licensing changes. And to Extra Class at the FCC office in Long Beach in November of 1977. Bob appreciates the help of Kei, W6NGO and Ted, K6LJA for numerous enjoyable CW QSOs to get his code speed up. In mid-1978 he was assigned his current call AF6C (Not a vanity call!). Bob has been active in OCARC since field day of 1969. Has served nearly continually on the Board since the early 1970's, and also as President in 1973, 1985 and 1996, and has held every officer position.

Bob runs the 60 Hz station AKA generator at Field Days, and stores and maintains it at his house ever since a fuel supply problem detracted Field Day in 2006. He also operates 20m Phone.

Bob's been making the laminated club badges (over 525) since 2000. Also, he's written numerous articles for our RF Newsletter including his Heathkit series that are read by hams around the world, and his "TechTalk" articles (Later "Bob's TechTalk"). He puts in countless hours on our website, including most of the heavy coding and also digitized many of the old copies of the RF. A few years ago he taught two soldering classes. He has been our QSL manager, and has been Trustee of our W6ZE callsign for 40 years! Bob has been active on our nets for decades, often as net control.

LIFETIME ACHIEVEMENT AWARD BIOGRAPHY

Ken Konechy, W6HHC

Ken was born near Pittsburgh PA. When he was 13 he got his novice call of WN3MHI. Ken and a few classmates started a ham radio club while in Junior High school. Upgraded to general as W3MHI. Ken went QRT to go to the University of Pittsburgh, but his ham license helped him qualify for a job at Pitt testing laboratory, first as an electrical technician, then as a research engineer, and got an MSEE degree.

He and his family moved to California in 1967, received the W6HHC callsign, and started working at Autonetics (aka Rockwell, Boeing). Also worked at Rainbow Technologies, and in his retirement, has managed the international team that has created DATV-Express, which is a transmitter and a receiver for the amateur form of Digital TV. He has presented this at TAPR and ARRL forums, and other conventions.

Ken has served on the OCARC board continuously since late 1967. Was Treasurer this year and will be Secretary next year. He has been President 4 times – 1974, 1988, 1991, and 2005. Along with AF6C he spearheaded the development of the W6ZE website when the internet was just getting started. The website continues to be the envy of other clubs, and Ken continues to keep it up to date. Ken's technical knowledge is vast, and he has shared it with the club over the years. There are RF articles on the website from the late 60's – early 70s that are an excellent tutorial on biasing a transistor. Ken is also a big fan of the Wednesday night nets, and has enjoyed them for years and years.

Ken has been a big part of our Field Day efforts since he joined. Can we say every year (all but 2), even at far-away Yucca Valley? The 20-meter phone station is Ken's favorite, as he handles the pileups well. Every year he takes the group photo. He has a tripod and timer on his camera and comes racing back to be in the pictures.



*** CONGRATULATIONS TO THE LIFETIME ACHIEVEMENT RECIPIENTS ***

WSJT-X Development Group Announces Version 2.0 of their Software

By Joe Taylor K1JT

The WSJT Development Group is pleased to announce the general availability (GA) release of WSJT-X Version 2.0.0. on Dec. 10, 2018.

If you have been using version 1.9.1 or earlier, or one of the candidate releases v2.0.0-rc#, it's important to upgrade now. The original protocols for FT8 and MSK144 are no longer supported. With v1.9.1 and earlier you cannot communicate with WSJT-X 2.0 using these modes.

We now recommend using WSJT-X 2.0 anywhere in the conventional FT8 and MSK144 sub-bands. Everyone should upgrade to v2.0 by no later than January 1, 2019.

NEW FEATURES IN WSJT-X 2.0

1. Compound and nonstandard callsigns are automatically recognized and handled using new FT8 and MSK144 message formats.

2. The new FT8 protocol provides optimized message formats for North American VHF contests, European VHF contests, ARRL Field Day, and ARRL RTTY Round-up. Similarly, the new MSK144 protocol provides optimized message formats for North American VHF and European VHF contests. Full support is provided for "/R" and "/P" calls in the relevant contests.

3. The new protocols provide nearly equal (or better) sensitivity compared to the old ones, and lower false decode rates.

4. New logging features are provided for contesting and for "Fox" (DXpedition) mode. Logging is optionally integrated with N1MM Logger+ and WriteLog.

5. Color highlighting of decoded messages provides worked-before status for callsigns, grid locators, DXCC entities, continents, CQ Zones, and ITU zones on a "by band" and "by mode" basis, and for stations that have uploaded their logs to Logbook of the World (LoTW) within a specified time interval.

6. The WSPR decoder now achieves decodes down to S/N = -31 dB. For the particular benefit of LF/MF users, an option "No own call decodes" has been added.

7. The UDP messages sent to companion programs have been expanded and improved.

A more detailed list of program changes can be found in the cumulative Release Notes:

http://physics.princeton.edu/pulsar/k1jt/Release_Notes.txt

Upgrading from earlier versions of WSJT-X should be seamless. There is no need to uninstall a previous version or move any files.

Please do not continue to use any release candidate -- that is, any beta release with "-rc#" in the version name.

Links to installation packages for Windows, Linux, and Macintosh are available here: http://physics.princeton.edu/pulsar/k1jt/wsjt_x.html

You can also download the packages from our SourceForge site:

<https://sourceforge.net/projects/wsjt/files/>
It may take a short time for the SourceForge site to be updated.

We hope you will enjoy using WSJT-X Version 2.0.0.

-- 73, Joe, K1JT, for the WSJT Development Group

Heathkit of the Month #89: by Bob Eckweiler, AF6C



ELECTRONIC TEST EQUIPMENT

Heathkit O-9 through O-12 Oscilloscopes.

Introduction:

In the first of this series of articles four Heathkit oscilloscopes, the O-1 through O-4, were discussed. In second article the fifth through eighth Heathkit oscilloscopes, the O-5 through O-8, were discussed¹. This third article discusses the last of the twelve 'O' series oscilloscopes, the O-9 through O-12.

The O-1 through O-6 sold for \$39.50; the O-7 sold for \$43.50, up 10%. The scope performance was improving with each new model and the price was also beginning to increase significantly. The O-8 price, increased almost 37% to \$59.50, and the the O-9 through O-12 sold in the \$65 to \$70 range. To meet the need of lower priced scopes, Heathkit started to release lower-performance ones starting in September 1954. These include the 3" OL-1 (\$29.50), and the 5" OM-1 through OM-3. (\$39.50 but later increased to \$49.50, \$42.50, \$39.95 respectively). Heathkit also produced a couple of higher performance and higher priced oscilloscopes, the 'Research' OR-1 oscilloscope and the 'Professional' OP-1 Oscilloscope. These boasted of a higher performance CRT, the 5ADP2, as well as true DC

Here is a link to the index of Heathkit of the Month (HotM) articles:

http://www.w6ze.org/Heathkit/Heathkit_Index.html

¹ Notes appear at the end of the article



Figure 1: The last of the Heathkit O-series scopes, the O-12. Photo by Chuck Penson - WA7ZZE

coupling, a sign of an advanced scope. They sold for \$119.95 and \$179.95 respectively.

A schematic and parts list are available online for the O-9 through O-12 (See note 5).

Heathkit introduced the O-9 to replace the O-8 in September of 1953. It remained in production until replaced by the O-10 in September one year later.

The O-10 was released in September of 1954 for \$69.50. Since the O-5, Heathkit had been releasing new scopes on a yearly basis in September. However, the O-10 through O-12 were each kept in production for more than one year.

O-9 to O-12 Tube Lineup

#	Function	O-9	O-10	O-11	O-12	
1.	B+ Rectifier	5Y3	6X4	6X4	6X4	Dual Diode FW
2.	HV Rectifier	5Y3 ¹	1V2 ²	1V2 ²	1V2 ²	{ ¹ Parallel diodes ² HV Rectifier
3.	Voltage Regulation	0D3	6C4	6C4	6C4	See text
4.	Vertical Input Buffer	6AB4	6AB4	6AB4	6AB4	Triode
5.	Vertical Preamplifier #1	½ 12AT7 ³	½ 6BQ7 ³	½ 6AN8 ³	½ 6AN8 ³	{ ³ triode section
6.	Vertical Preamplifier #2	½ 12AT7 ³	½ 6BQ7 ³	½ 6AN8 ⁴	½ 6AN8 ⁴	{ ⁴ pentode section
7.	Vertical Phase Splitter	6C4	none	none	none	triode
8.	Vertical Deflection Amplifier	½ 12AT7	½ 12BH7	½ 12BH7	½ 12BH7	dual triode
9.	Vertical Deflection Amplifier	½ 12AT7	½ 12BH7	½ 12BH7	½ 12BH7	dual triode
10.	Horizontal Phase Splitter	½ 12AU7	none	none	none	triode
11.	Horizontal Input Buffer	none	½ 12AU7	½ 12AU7	½ 12AU7	dual triode
12.	Horizontal Amplifier	none	½ 12AU7	½ 12AU7	½ 12AU7	dual triode
13.	Horizontal Deflection Amplifier	½ 12AT7	½ 12AU7	½ 12AU7	½ 12AU7	} 12AT7 dual triode 12AU7 dual triode
14.	Horizontal Deflection Amplifier	½ 12AT7	½ 12AU7	½ 12AU7	½ 12AU7	
15.	Blanking Amplifier	½ 12AU7	½ 12AT7	½ 12AU7	½ 12AU7	triode section
16.	Sweep Multivibrator	½ 12AT7 ⁵	6CB6 ⁶	6DT6 ⁶	½ 6J6 ⁵	{ ⁵ triode section ⁶ pentode
17.	Sweep Multivibrator	½ 12AT7	½ 12AT7	½ 12AU7	½ 12AU7	triode section
18.	Sync Buffer	none	none	none	½ 6J6	triode section
19.	Cathode Ray Tube	5UP1	5UP1	5UP1	5UP1	RCA Mfr.
Total Tubes:		11	11	11	11	
Total Tube Sections:		18	17	17	18	

Table I

ers change either to improve performance or possibly due to economic considerations.

The following sections contain some circuit discussion. However since the previous two articles cover the circuits in detail, the focus here will be on changes made in each scope.

The Heathkit O-9 Oscilloscope:

The O-9 is a nice update to the O-8. A new **1V** output replaces the 60 CY. TEST binding post. It has a 1V peak-to-peak output, derived from the filament voltage, that can be calibrated by an internal potentiometer. The O-8 is also the first of the 'O'-series scopes to have retrace blanking, since the crude version on the O-1. Due to the new line sweep

and sync capability, the front panel layout has changed in places.

O-9 Front Panel:

The O-9 front panel (refer to Figure 2) is similar to the O-8. The four controls around the CRT remain unchanged. Clockwise from the upper left they are: **INTEN.**, **FOCUS**, **HORIZONTAL CENTERING** and **VERTICAL CENTERING**. Also the row directly below the CRT remains identical except for the sweep frequency selector ranges; left to right they are: **VERT. GAIN**, **FREQ. SELECTOR** and **HOR. GAIN**. The next row down left to right are the **VERT. INPUT** attenuator, the **FREQ. VERIER** and the new line sweep **PHASE** control.

The next lower row is changed and controls are staggered vertically along the row to accommodate two new control locations that replace two of the slide-switches. This next row and the one below it, from left to right, are: The **VERT. INPUT** binding post, with its associated **GND.** below it; The **SYNCHRONIZING** control, which used to be where the **PHASE** control is now, and below it the **EXT.** sync binding post; a red jewel pilot lamp , and below it the power **OFF - ON** slide-switch; the new **HOR. SELECTOR** 5-position rotary switch and below that the **1V** calibration binding post; and finally the **HOR. INPUT** binding post and below that the associated **GND** post. The five positions of the **HOR. SELECTOR** switch, in clockwise direction are: **EXT. SWEEP**, **LINE SWEEP**, and three internal **SWEEP SYNC.** positions: **LINE**, **INT.** and **EXT.**

The O-9 Circuit Description:

There are seven discussion points in the O-9 through O-12 oscilloscope circuits; the B+ and HV power supplies, the vertical amplifier, the horizontal amplifier, the sweep and sync circuits and the blanking amplifier.

O-9 B+ Power Supply:

A new power transformer is used in the O-9. It is similar in lead color-coding and voltage, but has higher current output in the 700 VAC B+ secondary. The B+ power supply has four voltage outputs, the highest being around 400 volts. An OD3 volt gas regulator tube provides 150 volts and two other voltages that are tapped off and filtered to drive the lower voltage circuits. The vertical buffer is isolated using one of these voltages; it is not isolated in the O-8. The O-9 uses four 20 μ f capacitors in a can, while the O-8 uses two 20 μ f and two 10 μ f for B+ filtering.

O-9 HV Power Supply:

Since the CRT changed, the resistor voltage divider chain to supply the correct CRT volt-

ages has also changed. Other than that and more HV power supply filtering, the circuit is quite similar to the O-8.

O-9 Vertical Amplifier:

The O-8 6J5 octal tube vertical input buffer has been replaced with a miniature 6AB4 7-pin triode. The three stage attenuator has not changed except for one resistor to compensate for the bias circuit required for the new tube.

The vertical amplifier and driver are similar to the O-8 but include significant component value changes that increase frequency response. The O-9 doubles the O-8 high frequency response at the -2 db point to 2 mc, (3 mc at -6 db).

O-9 Horizontal Amplifier:

The horizontal amplifier phase splitter is changed from a 6J5 octal tube to a section of a miniature 9-pin 12AU7 dual-triode. The other section is used as the blanking amplifier. Other than that, and a few changes in component values, most notably larger coupling capacitors, and cathode resistors, the circuit is the same as the O-8.

O-9 Sweep Oscillator:

The sweep circuit is driven from the highest B+ voltage as this allows better sweep linearity. The only change to the sweep generator is an increase in the cathode resistor, perhaps to raise sweep to a more linear portion of the RC charging curve. The sweep ranges remain the same as the O-8.

O-9 Sync. Circuit:

The sync circuit is identical to the O-8. Instead of using a slide switch to select \pm sync, the identical function is inserted in the **HOR. SELECTOR** switch. In the **EXT. SWEEP**, and **LINE SWEEP** positions sync is not connected. In the first of the three **SWEEP SYNC** positions some of the filament voltage is connect-

ed to the sync line, and the last two positions, INT. and EXT. imitate the O-8's slide switch.

O-9 Blanking Circuit:

A blanking circuit turns off the CRT electron beam while the trace is moving rapidly back from the right side of the screen to the left side. Except for an early attempt with the O-1, Heathkit relied on the rapid movement of the trace back to the left to create such a dim trace that it was acceptable. In most cases it was. In the O-9 Heathkit dedicated the triode section of a 12AU7 tube to turn on during the blanking portion and apply a negative voltage pulse to grid-one of the CRT via the intensity modulation input to turn off the trace.

O-9 Construction:

Heathkit was continually trying to reduce costs of their kits and at the same time simplify construction whenever they could. The O-9 is the first of the Heathkit oscilloscopes that utilizes a prefabricated wiring harness to simplify construction. While probably more expensive for Heathkit, it offered easier and faster construction and reduced mistakes during assembly.

The Heathkit O-10 Oscilloscope:

The O-10 (**Figure 3**) was introduced in September of 1954 with the new Classic I style⁴ with a dark gray front panel, white lettering and a slightly lighter gray cabinet.

The O-10 has many changes from the O-9. It is the first O-series oscilloscope to use printed circuit boards, and two of them no less. The lower cost OL-1 and OM-1 scopes, introduced the same month, also use circuit boards, though only one in each. And the OL-1 and OM-1 used the same printed circuit board, though some of the component values are different. The printed circuit board made construction easier and Heathkit's manufac-



Figure 3: Heathkit O-10 Oscilloscope; the last of the Late Pre-Classic style scopes. Photo by Chuck Penson.

turing costs less. Circuit boards were inexpensive to manufacture in moderate quantities, and the reduction in the cost of chassis machining, mounting hardware, terminal strips, and even some components helped Heathkit keep prices down. The increased ease of construction, and consistent wiring layout resulting in stability between units built, made more complicated kits possible without added difficulty for the builder. Heathkit appeared focused on making their kits easier to assemble and less likely to need to be returned for repair, which probably was a big expense for them.

Besides printed circuit boards, the O-10 also was the first Heathkit scope that used all miniature tubes (excluding the CRT). The three remaining octal tubes of the O-9, the two 5Y3 rectifiers and the OD3 VR tube no longer were used.

Another feature of the O-10 is a new voltage regulation circuit. Instead of using a VR tube, the O-10 measures the CRT high voltage and adjusts the B+ voltages to correct the trace deflection when the CRT acceleration voltage changes with line voltage.

O-10 Front Panel:

The layout of the O-10 front panel appears almost identical to the O-9, color scheme excepted. The obvious change is the OFF - ON slide switch is gone. The fully CCW position of the INTENSity control on the upper left is now marked **A.C. OFF**. The pilot light remains where it is on the O-9.

There are also many less noticeable changes: The **FREQ. SELECTOR** switch is now marked **HOR. / FREQ. SELECTOR** with two added positions, **EXT. INPUT** and **LINE SWEEP**. The **SYNCHRONIZING** control is now called **SYNC AMPLITUDE** and it no longer is divided with negative sync to the left of center and positive sync to the right. The **HOR. SELECTOR** is now named **SYNC. SELECTOR**, and gone are the **EXT. INPUT** and **LINE SWEEP** positions; the remaining three positions that were under **SWEEP SYNC** are now four positions: **-INT.**, **+INT.**, **LINE** and **EXT.**. The last change is the **1-V P-P** and the **EXT. SYNC**. binding posts locations have been swapped.

The O-10 Circuit Description:

The circuitry of the O-10 shares little with the previous O-series scopes, though the functions remain the same. Heathkit was striving for better vertical bandwidth and

improved linearity of the sweep circuit. The O-10 vertical and horizontal amplifiers, except for some minor component changes, remains the same for the O-11 and O-12. The O-10 sweep circuit is described in the manual as *"utilizing Heath sweep circuit. (Patent applied for.)"*. Still, the circuit was further refined in the O-11 and O-12.

O-10 B+ Power Supply:

In order to use miniature rectifier tubes the power transformer was changed. The two 5V filament windings for the 5Y3GT tubes are gone. The new seven-pin 6X4 rectifier tube has a 6.3 V heater. The 6.3V winding received a center-tap which is connected to ground; this is possibly to reduce stray 60 cps. radiation within the scope cabinet.

Voltage regulation is handled by a 6C4 triode. The grid is connected to the bottom of the CRT high-voltage chain. Should the high voltage increase, due among other reasons by the line voltage changing, the 6C4 grid goes more negative and the tube conducts less, raising the voltages on numerous circuits, increasing the vertical and horizontal gain countering the lower deflection that occurs when the acceleration voltage increases.

O-10 HV Power Supply:

The 5Y3 rectifier is gone and a nine-pin single diode 1V2 high voltage rectifier tube, which easily handles the 1,200 VDC CRT voltage, replaces it. The new power transformer has a 0.62 V winding for the 1V2 tube filament. This winding is a few extra turns at the top of the high voltage winding.

The CRT voltage divider chain is the same as the O-9 except the **FOCUS** control is 1 M Ω (was 2 M Ω) and a 15 K Ω resistor is added at the bottom of the chain to provide a tap for the voltage regulator circuit.

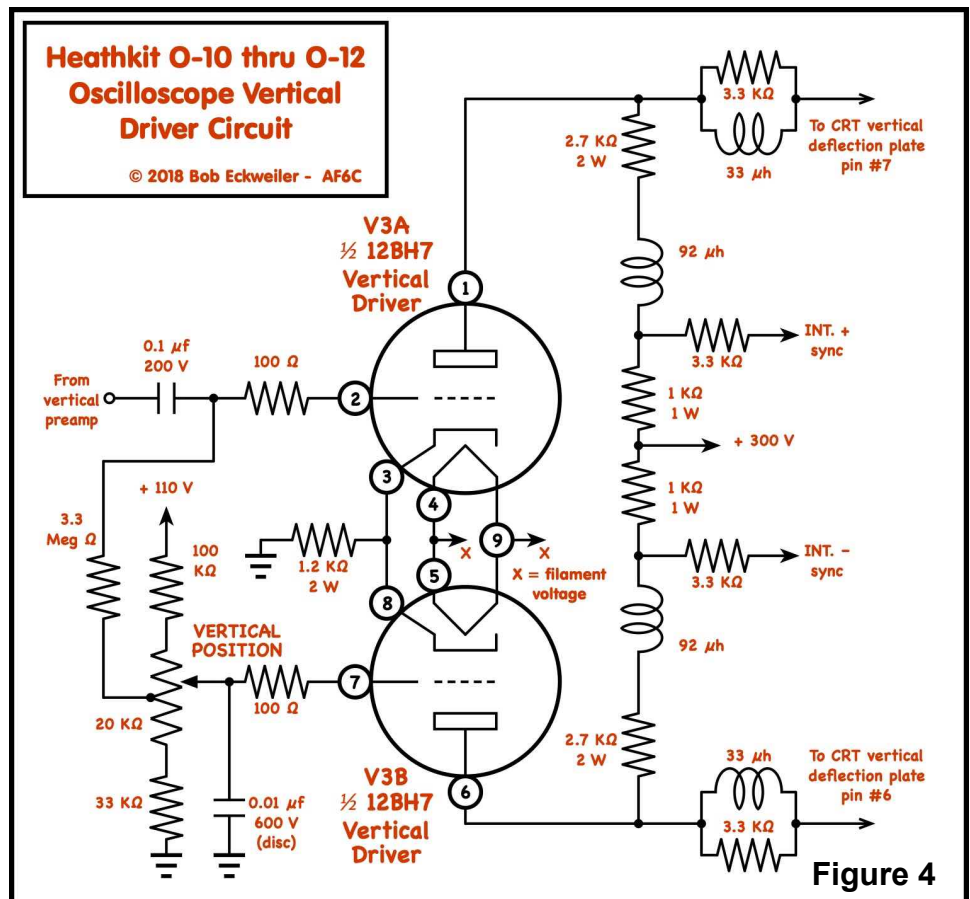
O-10 Vertical Circuits:

The vertical attenuator circuit was changed from two separate dividers for the x10 and x100 positions to a series divider that handles both. The buffer for the attenuator is also changed adding some feedback to enhance input impedance and high-end frequency response.

The output of the buffer is amplified by both sections of a 6BQ7A dual triode in cascade. Each amplifier uses a peaking coil to enhance the vertical response. These coils in effect raise the plate resistance at higher frequencies increasing the gain to compensate for tube loss. While Heath used peaking coils in the vertical driver, this is the first use in the pre-driver stages.

The use of peaking coils rule out the use of a phase-splitter for the driver stage. Thus, a new driver circuit that allows position control, synchronization taps and push-pull output was developed. This circuit continued to be used through the O-12 without modification.

Referring to **Figure 4**: The AC signal is coupled to the grid of V3A and then to V3B through the common 1.2K Ω cathode resistor. Since the voltage across this resistor remains nearly constant, when V3A draws more current less current flows through V3B. With the VERTICAL POSITION pot at center, the voltage on the two grids are the same (since no current is flowing, the drop across the 3.3 M Ω resistor is negligible). As the pot is moved the DC bias on the two tubes changes and one tube draws more current. The DC

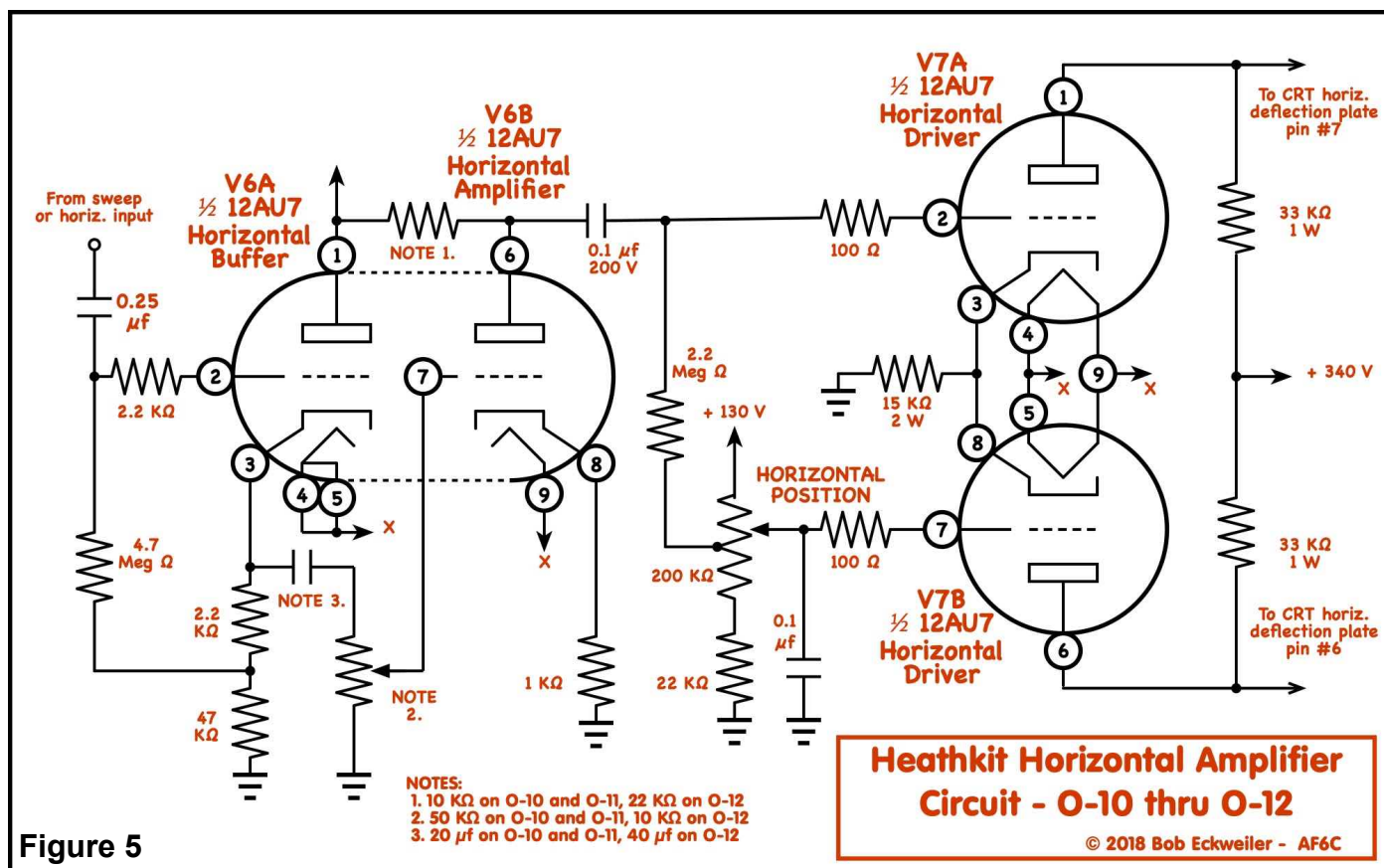
**Figure 4**

voltage on the vertical deflection plates differ and the trace is moves to a different vertical position on the screen. The 100 Ω resistors in the grid circuit are for parasitic suppression.

The plate supply is 300 VDC and the each plate circuit consists of 3.7 K Ω in series with 92 μ h. the inductance increases the plate resistance at higher frequencies increasing gain as the tube losses mount, extending the high end frequency response. The driver plates are also coupled to the deflection plates through a coil shunted by a resistor. My guess is that this is to help cancel the wiring and deflection plate capacitance at the higher frequencies.

O-10 Horizontal Amplifier Circuit:

The O-10 horizontal amplifier/driver is a totally new circuit. It is based on the vertical circuit, without the need to have high gain and high frequency response. The O-10 has a



maximum gain of about 0.6 Vrms per inch of deflection and a frequency response up to about 500 kc. The new circuit is shown in **Figure 5**.

Two 12AU7 dual triodes are used in the horizontal circuits. The first stage acts as a cathode follower–buffer. It uses feedback from the cathode to the grid to increase the input impedance. This high impedance is needed due to the new sweep oscillator circuit. The saw-tooth sweep voltage is taken directly from the sweep capacitor.

The second half of the first 12AU7 is a simple voltage amplifier with a gain of about 10. It drives the second 12AU7 in basically the same circuit as the vertical driver circuit, but without the added components to increase frequency response. The actual components used are different than the vertical amplifier due to the difference in needed gain and the use of a 12AU7 instead of the higher power 12BH7.

O-10 Sweep Circuit:

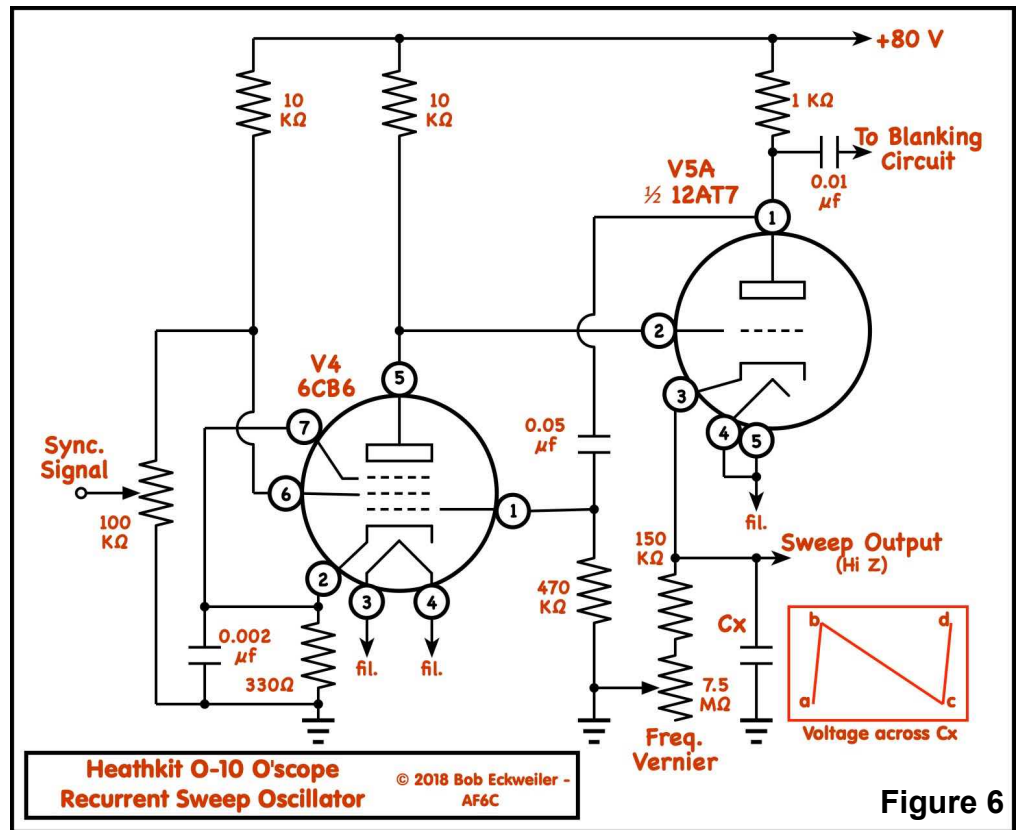
Heath called its newly patented sweep circuit for the O-10 a “*recurrent type*”. In the O-10 it consists of a pentode and the triode section of a 12AT7. Heath never discussed its operation in their manuals. Here is the author’s take on it. See **Figure 6**:

Assume at the beginning (point ‘a’ on the Cx graph) that V4 is in cutoff and the timing capacitor Cx is discharged. The grid of V5A, thus is highly positive with respect to its cathode and current flows through the tube heavily, rapidly charging Cx. As Cx charges the cathode voltage of V5A climbs until it begins to turn off. The reduction in plate current causes the grid voltage of V4 to climb and it begins to turn on, driving V5A to shut down faster (point ‘b’). With V5A shut-down Cx begins to discharge through the FREQ. VERNIER control and its fixed series resistor. This is the ramp that is amplified

and fed to the horizontal deflection plates. As the voltage across C_x gets smaller current begins to flow in V5A driving the grid of V4 towards negative and turning it off, which increases the grid voltage, making V5A turn on even faster (point 'c'). With V5A off C_x begins charging again reaching the point where C_x is fully charged and V5A is ready to turn on again (point d). The resulting ramp from 'b' to 'c' is fed to the horizontal amplifier to move the trace from left to right at a reasonably constant rate. The speed of the ramp is governed by the speed of discharge of C_x . Coarse adjustment is done by switching the capacitor C_x in approximately decade steps; the fine adjustment is done with the 7.5 M Ω frequency vernier control.

O-10 Sync. Circuit:

Heath seemed to be trying to continually improve the synchronization circuit. Improvements in the O-10 include separate plus and minus sync selection by a switch, instead of using half the center tapped sync level pot for positive and the other for negative sync. The AC line sync is now fixed, and the phase control only affects the horizontal line sweep. This allows syncing on different parts of the horizontal sweep. The sync signal is fed to the screen grid of the sweep circuit causing it to lock the sweep circuit to the sync signal when the sweep frequency or one of its harmonics is close to the sync signal.



O-10 Blanking Circuit:

V5B (See full O-10 schematic online ⁵) acts as a blanking amplifier. It is normally conducting. The cathode of the CRT is generally less negative than the first grid. As the voltage gets further apart less beam current flows until the CRT is cutoff. The blanking amplifier, V5B, is capacitively coupled to the plate of V5A. When V5A turns on (at 'a' and 'c' on the C_x voltage graph) a negative pulse is coupled to the grid V5B causing it to turn V5B off. The resulting positive pulse is capacitively coupled to the CRT cathode, making it more positive, cutting off the trace as it rapidly returns to the left of the screen. This is known as the retrace period.

O-10 Comments:

After nine previous scopes in the O-series, all viable instruments that found a lot of use by TV and radio repairmen, radio amateurs and electronic hobbyists, Heathkit was reaching a point where the O-series oscilloscope design

was close to the best kit scope that could be built for the price. Much of the O-10 circuit design continued to be used on the two final scopes in the series as well as the early IO-series until that series switched to solid-state circuitry.

The Heathkit O-11 Oscilloscope:

After a two year run the O-10 was updated to the O-11 (**Figure 7**) in September of 1956. A lot of the circuitry remained the same or underwent minor changes. The O-11 sold for \$69.50 until April of 1958 when it was superseded with the O-12.

O-11 Front Panel:

An examination of the O-11 front panel layout shows it to be identical to the O-10 with one simple exception; the pilot lamp lens is no longer a jeweled lens, instead it is a green plastic dome lens. Of course the model number was incremented to O-11 also.

The O-11 Circuit Description:

There were only minor changes between the O-11 and its predecessor.

O-11 Power Supplies:

No changes were spotted between the O-10 and O-11 HV nor B+ power supplies. The CRT divider chain remained unchanged as did the voltage regulator circuit, with the exception of the dropping resistor for the 100 V tap. It changed from 1.5 K Ω to 3.3 K Ω .

O-11 Vertical Circuits:

There were some changes in the buffer/follower circuit. The preamplifier tube was changed from a 6BQ7A dual-triode to a 6AN8 triode/pentode. At the first vertical amplifier stage (V2A-6AN8 triode section) the plate resistor was increased from 2.2 K Ω to 2.4 K Ω , and the second stage V2B-6AN8 pentode section) the series plate inductor was decreased from 92 to 61 μ H and the parallel inductor to the driver was increased to 30 μ H. These were probably



Figure 7: Heathkit O-11 Oscilloscope. Except for the pilot lens and model # the front panel is identical to the O-10. Photo by Keith Greenhalgh.

done to enhance frequency response to make it more in-spec. The screen of the 6AN8 pentode is connected directly +100 V feeding the two preamplifier stages.

O-11 Horizontal Amplifier Circuit:

There were no changes from the previous model. Refer to **Figure 5** for the O-11 horizontal circuit schematic.

O-11 Sweep Circuit:

The sweep circuit changes to the O-11 are the 6CB6 (V4) tube has been replaced with a 6DT6 and the 12AT7 (V5) to a 12AU7. This results in a change to the V4 and V5A plate resistors and removal of the V4 cathode re-

sistor and its bypass capacitor. But the remainder of the circuit, its component values and operation remain unchanged as does its function. The reason for the (V4) tube change is discussed in the next section.

O-11 Sync. Circuit:

The 6DT6 pentode is classified as having “two independent control grids”. In the O-10 the sync signal is coupled to the screen grid; while in the O-11 it is coupled directly to grid three (the second control grid) which is much more sensitive allowing syncing with a smaller signal.

Due to the higher sync. sensitivity Heath changed the SYNC. AMPLITUDE potentiometer from a linear-taper to an audio-taper. A linear-taper control reaches 50% of the full resistance at 50% rotation, while an audio-taper reaches about 10% of the full resistance at 50% rotation. This makes adjustment less critical for large sync signals even with the added sensitivity.

O-11 Blanking Circuit:

Though V5B has been changed to a 12AU7, the circuit and components remain the same. This tube acts as a switch and is either on or off. The reason for the V5 tube change from a 12AT7 to a 12AU7 is not known. While the 12AT7 was used extensively in O-7 through O-9, only one was used in the O-10. Meanwhile the 12AU7 was being used more. Thus this change could have been for an economic reason and not an engineering reason.

The Heathkit O-12 Oscilloscope:

In May of 1958 The O-12 appeared, replacing the O-11. The text from the April and May 1958 issues of *Radio News* are shown in **Figure 8**. The one significant change between the two scopes was not even mentioned: Heath doubled the sensitivity of the horizontal amplifier to 0.3 volts per inch. A new ad

appeared in the June issue with more detail, but no “NEW” banner. Perhaps it was an advertising deadline driving the May ad. Other changes Heathkit made was adding one resistor to the vertical amplifier and doing another redesign of the sync circuit.

O-12 Front Panel:

The O-12 front panel appears identical to the O-11 except the model designation and one control. The SYNC. AMPLITUDE control has been renamed to the **EXT. SYNC. AMPLITUDE** control because the internal sync no longer needs a gain setting.

O-12 Power Supplies:

No changes of consequence were found in the O-12 power supplies nor in the CRT chain.

O-12 Vertical Circuits:

The only circuit note was a low value (220 Ω) resistor added between the VERTICAL GAIN control and ground, setting a minimum gain.

O-12 Horizontal Amplifier Circuit:

Two resistors and a capacitor were changed to double horizontal amplifier sensitivity from 0.6 volts per inch to 0.3 volts per inch. The note in **Figure 5** shows the changes.

O-12 Sweep Circuit:

The 6DT6 vacuum tube (V4) has been replaced with a triode section of a 6J6 dual triode (now V4B). Operation of the sweep circuit continues basically unchanged.

O-12 Sync. Circuit:

Heath engineers finally separated the sync amplification from the sweep oscillator. The other half of the 6J6 (V4A) is used as a sync amplifier. It also acts as a clipper allowing the scope to sync to waveforms from the vertical amplifier. Since there is no longer a need for a gain control for internal sync. that gain control has been renamed EXT. SYNC AMPLITUDE . The control remains at the same

HEATHKIT "EXTRA DUTY" 5" OSCILLOSCOPE KIT

This fine oscilloscope compares favorably to other scopes costing twice its price. It contains the extra performance so necessary for monochrome and color-TV servicing. Features push-pull horizontal and vertical output amplifiers, a 5U1 CRT, built in peak-to-peak calibration source, a fully compensated 3-position step-type input attenuator, retrace blanking, phasing control, and provision for Z-axis modulation. Vertical amplifier frequency response is within ± 1.5 and -5 db from 3 CPS to 5 MC. Response at 3.58 MC down only 2.2 db. Sensitivity is 0.025 volts RMS /inch at 1 kc. Sweep generator covers 20 CPS to 500 kc in five steps, five times the usual sweep obtained in other scopes through the use of the patented Heath sweep circuit. Etched-metal circuit boards reduce assembly time and minimize errors in assembly, and more importantly, permit a level of circuit stability never before achieved in an oscilloscope of this type. Shpg. Wt. 21 lbs.

MODEL O-11

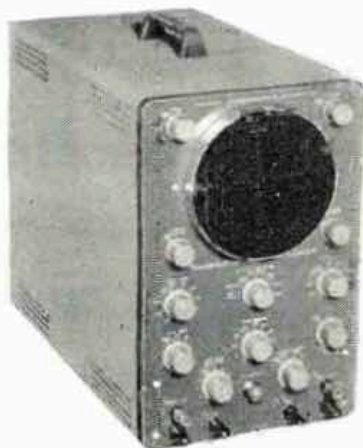
\$69⁵⁰**HEATHKIT "EXTRA DUTY" 5" OSCILLOSCOPE KIT**

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MODEL O-12

\$64⁹⁵

Figure 8: On the left is the text from the April 1958 issue of Radio News advertising the O-11; ads with identical text had appeared in earlier issues. On the right is text from the May 1958 issue advertising the O-12. The ad has the identical text, only the model number and price have changed.



**Laboratory
Performance At Less
Than Utility Scope
Price**

HEATHKIT
O-12**\$64⁹⁵****"EXTRA DUTY" 5" OSCILLOSCOPE KIT**

Top quality features at half the cost of ordinary equipment sum up the advantages of this popular kit. Critical observations in your laboratory or shop are handled easily, with clear, sharp pattern displays in every application. Vertical frequency response extends from 3 CPS to 5 mc ± 1.5 db -5 db without extra switching. Response is down only 2.2 db at 3.58 mc. The Heath patented sweep circuit functions effectively from 10 CPS to better than 500 kc in five steps, giving you 5 times the usual sweep obtained in other scopes. An automatic sync circuit with self-limiting cathode follower provides excellent linearity and lock-in characteristics. Extremely short retrace time and efficient blanking action. Both vertical and horizontal output amplifiers are push-pull and the scope incorporates a 1 V peak-to-peak calibrating source, step attenuated and frequency compensated vertical input, plastic molded capacitors and top quality parts throughout. The 11-tube circuit features a 5U1 cathode ray tube, and provision is made for Z-axis input for intensity modulation of the beam. Frequency response of the horizontal amplifier is within ± 1 db from 1 CPS to 200 kc. Horizontal sensitivity is 0.3 volts RMS per inch. Construction is simplified through the use of two metal circuit boards and pre-cut, cable wiring harness. Shpg. Wt. 22 lbs.

location on the front panel, but now only adjusts the level of an applied external sync signal. The internal sync signals are now coupled to the sweep oscillator by a common cathode resistor between the two triode sections of V4.

The End of an Era:

In 1960 the O-12 was replaced with a new scope series starting with the IO-30. The IO-30 features a heavier-duty power supply and two fixed sweep frequencies that can be preset and selected from the front panel. It also incorporates a short lived style that was a derivative of the Classic I style.

← **Figure 9:** This June 1958 ad shows more information than in May including the new horizontal sensitivity of 0.3 V/in and an increased shipping weight.

Comments:

This is the final article in the 'O' Series Heathkit scope article. These scopes are the first series of test equipment that helped make Heathkit well known as the leader in electronic kits for almost half a decade. Here are a few other pieces of information that might be of interest.

Transformers are one of the more expensive pieces of a scope. Originally Heath started out with a heavy WWII surplus transformer. The O-2 transformer was a lot smaller and lighter, but still believed to be war surplus. The O-3 through O-5 used the same transformer, but it was changed for the O-6. Between the O-6 and the O-7 Heath changed its part numbering scheme, so it's hard to say whether they are the same or not. Looking at the schematic, they have identical windings but the O-6 schematic does not give voltages nor currents for the transformer, while the O-7 does. Heath again changed the power transformer for the O-8 and again for the O-9. It was changed again for the O-10, but this transformer continued to be used by the O-11 and the O-12. **Table II** shows the part numbers of the 'O'-series oscilloscopes.

Heath continued to strive to increase the frequency response of these scopes. Probably the biggest reason was for television servicing. A frequency of importance was 4.5 mc so to have a frequency of 5 mc was ideal. Heath reached it, but with some loss with the O-10,

O-SERIES POWER TRANSFORMERS

O-1	Surplus	O-7	54-1
O-2	Smaller surplus	O-8	54-18
O-3	O-72*	O-9	54-19
O-4	O-72*	O-10	54-26
O-5	O-72*	O-11	54-26
O-6	O-125*	O-12	54-26

* Early Heathkit parts numbering system

Table II

SWEEP FREQUENCY SELECTOR RANGES

	O-9 ^a	O-10	O-11 / O-12
1.	15 - 180	60 cps - Line	60 ~ - Line
2.	180 - 1800	20 - 100	10 - 100
3.	1800 - 12 kc	100 - 1000	100 - 1000
4.	12 kc - 100 kc	1000 - 10 kc	1000 - 10 kc
5.	n/a	10 kc - 100 kc	10 kc - 100 kc
6.	n/a	100 kc - 500 kc	100 kc - 500 kc

a. Same sweep ranges as the O-8

kc = kilocycles, all others are cps (cycles per second)

Table III

not that the earlier scopes were totally blind at that frequency. The last three scopes are specified at being 5 db down at 5 mc (1 kc reference). this means that if the gain is set so a 1 kc 1 volt signal produces a 2" deflection, then a 5 mc 1 volt signal will produce a deflection of about 1-1/4 inches.

With the advent of color television another frequency became important. A scope needed to see the color-burst frequency of 3.58 mc. Thus, starting in 1954, Heath added a spec for the vertical response at that frequency. This was specified at -1.5 db on the O-10, which might have been a bit optimistic because it was lowered to -2.2 db on the two later scopes. Against the same reference as above -2.2 db means a 3.58 mc signal of 2 volts would produce a deflection slightly more than 1-1/2 inches.

Heath also spent a lot of effort improving the sweep frequency range. Table III show the ranges as they appear on the front of each of the last four model scopes. These numbers didn't alway jibe with the specifications given in ads and possibly in the manuals. Any little unspecified added range at the ends of the fine sweep control should be thought of as a feature.

Specification	O-9	O-10	O-11	O-12
Announced Date: Discontinued Date:	September 1953 August 1954	September 1954 August 1956	September 1956 April 1958	May 1958 November 1960
VERTICAL AMPLIFIER	Push - Pull	Push - Pull	Push - Pull	Push - Pull
Input Impedance	2 MΩ / 47 μpf (x1) 2 MΩ / 35 μpf (x10/x100)	2.9 MΩ / 21 μpf (x1) 3.4 MΩ / 12 μpf (x10/x100)	2.9 MΩ / 21 μpf (x1) 3.4 MΩ / 12 μpf (x10/x100)	2.9 MΩ / 21 μpf (x1) 3.4 MΩ / 12 μpf (x10/x100)
Sensitivity (volts per inch)	0.025 Vrms @ 1 kc	0.025 Vrms @ 1 kc	0.025 Vrms @ 1 kc	0.025 Vrms @ 1 kc
Freq. Response.	± 2 db 10 cps 2 mc ± 6 db 5 cps 3 mc	± 1 db 6 cps 2.5 mc +2 to -5 db 2 cps 5 mc -1.5 db @ 3.58 mc	± 1 db 8 cps 2.5 mc +1.5 to -5 db 3 cps 5 mc -2.2 db @ 3.58 mc	± 1 db 8 cps 2.5 mc +1.5 to -5 db 3 cps 5 mc -2.2 db @ 3.58 mc
Attenuator	x1 / x10 / x100	x1 / x10 / x100	x1 / x10 / x100	x1 / x10 / x100
HORIZONTAL AMPLIFIER	Push - Pull	Push - Pull	Push - Pull	Push - Pull
Input Impedance	1 MΩ	30 MΩ / 31 μpf	30 MΩ / 31 μpf	30 MΩ / 31 μpf
Sensitivity (volts per inch)	0.6 Vrms @ 1kc	0.6 Vrms @ 1kc	0.6 Vrms @ 1kc	0.3 Vrms @ 1kc
Freq. Response H Amp.	± 6 db 10 cps 500 cps	± 1 db 1 cps to 200 kc ± 3 db 1 cps to 400 kc	± 1 db 1 cps to 200 kc ± 3 db 1 cps to 400 kc	± 1 db 1 cps to 200 kc ± 3 db 1 cps to 400 kc
SWEEP CIRCUIT	Multivibrator	Recurrent Type	Recurrent Type	Recurrent Type
Horizontal Sweep Range	10 cps to 50 kc	20 cps to 500 kc	20 cps to 500 kc	10 cps to 500 kc
Range Switch Positions	4	5 + Line	5 + Line	5 + Line
60-cycle Test Voltage Post	Yes, 1 V p to p	Yes, 1 V p to p	Yes, 1 V p to p	Yes, 1 V p to p
SYNCHRONIZATION	from phase splitter	From Vert. amp plate	From Vert. amp plate	From Vert. amp plate
External Input	± Int., ± Ext, Line	± Int., ± Ext, Line	± Int., ± Ext, Line	± Int., ± Ext, Line
Power - 50/60 cps	105/120 VAC 70 W	105/125 VAC 80 W	105/125 VAC 70 W	105/125 VAC 70 W
Fuse	One @ 1½ amp (internal)	None	One @ 1½ amp (internal)	One @ 1½ amp (internal)
Electrostatic CRT Shield	No	No	No	No
Astigmatism (spot) Control	Yes	Yes	Yes	Yes
Direct Input to CRT Deflection Plates	Yes	Accessible - See Text	Accessible - See Text	Accessible - See Text
'Z' Intensity Modulation Input	Yes	Yes	Yes	Yes
Size H" x W" x D"	14-1/8 x 8-5/8 x 16	14-1/8 x 8-5/8 x 16	14-1/8 x 8-5/8 x 16	14-1/8 x 8-5/8 x 16
Shipping (Net) Weight - lb.	26 (18-1/2)	27 (20-1/2)	21 (20-1/2)	21 (20-1/2)
Price US\$	\$59.50	\$69.50	\$69.50	\$64.95
COLOR KEY:	From manual specs.	From flyer ads	From scope photos or schematic	
Table IV: Heathkit O-5 through O-8 Specifications (Table notes on next page)				

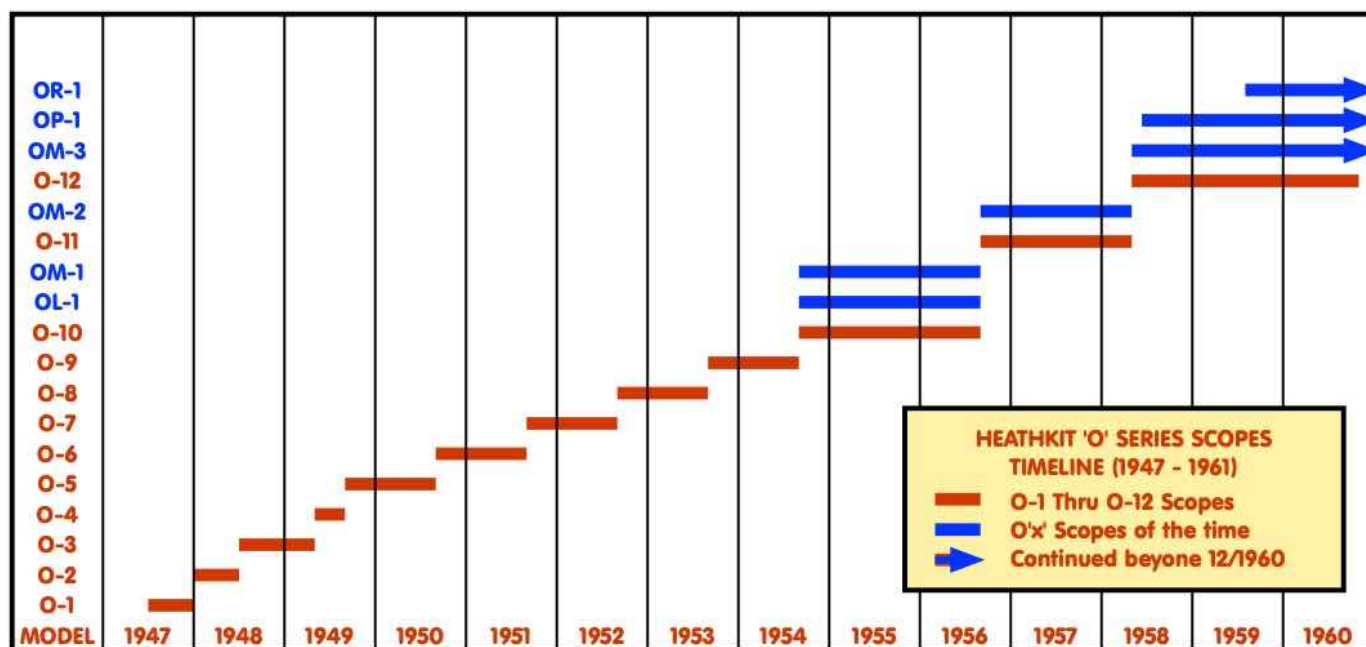


Table V: A timeline of Heathkit 'O' series scopes as well as other scopes offered at the time.

Table IV sums up the specifications for the last four 'O' series oscilloscopes, and **Table V** is a timeline of the twelve 'O'-series scopes and includes the other scopes that Heathkit offered between its epoch and the end of 1960.

Author Comments:

This has been an interesting series to write on. Heathkit was growing up during this period and these kits are a history of that. I have an O-12 and an OL-1 scope that I plan to restore. Many replacement parts are in-house so I just need the time to get working on them. In the cue is also a Heathkit AR-3, and SW-717 shortwave receiver, and a lot of non Heathkit electronics.

In the next few months I'll be writing on some smaller kits so the articles will be shorter, and maybe I'll have time to work on some of the projects too. Next month I plan to cover the GW-31. A handheld transceiver. I had a pair of them back in the very early sixties.

73, from AF6C



Notes:

- The first two articles may be found here:
http://www.w6ze.org/Heathkit/Heathkit_085_O1_O4%20Scopes.pdf
http://www.w6ze.org/Heathkit/Heathkit_087_O5_O8%20Scopes.pdf
- Radio News** began in July of 1919 as **Radio Amateur News**. In July of 1920 the word 'Amateur' was dropped, and in August of 1948 **Radio News** became **Radio & Television News**. In April of 1957 it was shortened to **Radio & TV News**. In May of 1959 the name was changed to **Electronics World** which remained in publication through 1971. In January of 1972 it merged with **Popular Electronics**.
- Later, O-10 thru O-12 scopes may use 5UP1 CRTs from other prominent manufacturers (Sylvania, Philips, and others)
- See Chuck Penson - WA7ZZE's book **Heathkit Test Equipment Products** for a description of the various test equipment styles starting on page iv.
- Schematics and parts lists for the 'O' series scopes may be found online at: http://www.w6ze.org/Heathkit/Sch/O_scopes.html

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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

PUZZLER

December 2018 Puzzler:

As the Christmas dinner was breaking up, two club members decided to play a few rounds of “high-card, math-style”. Borrowing the ten card deck used for the prize drawing from Ron - W6WG, they proceeded to play two hands.

Probably everyone is aware of “high-card”. where two or more participants draw a card from a deck of cards, and the one with the high card wins. This is often done to see who goes first in another contest.

“High card math-style” is different. There are two players and each draws a single card (in this case from a deck with ten cards, ace through 10, with the ace counting as a one). The rest of the cards are not used. Each player privately looks at his/her card. The winner is not the one with the high card but the first one who KNOWS which player is holding the high card. Each player takes a turn by saying either “I have the high card”, “[My opponent] has the high card”, or “I don’t know”.

The players that Christmas dinner were Fried - WA6WZO and Bob - AF6C, and it was decided (perhaps by “high-card”) that in the first game Fried would go first. The first game proceeded thusly:

- 1. Fried says: “I don’t know”.*
- 2. Bob says: “I don’t know”.*
- 3. Fried says: “I don’t know”.*
- 4. Bob says: “I don’t know”.*
- 5. Fried says: I have the high card”!*

The question is: There are two possible cards Fried was holding. What are they?

In the second game Bob starts first, and the game proceeded thusly:

- 1. Bob says: “I don’t know”.*
- 2. Fried says: “I don’t know”.*
- 3. Bob says: Fried is holding the high card.*

The next question is: There are two possible cards Bob was holding. What are they?

Send your answers to puzzler@w6ze.org

Answer to last month's (November 2018) Puzzler:

A colleague recently commented; "Halloween and Christmas must be the same holiday since their dates are the same!"

I replied wisely; "Huh???"

"It's true." he replied, while taking out a sheet of paper and writing on it:

OCT. 31 = DEC. 25

"Oh, you're right!" I replied, "What you wrote is correct."

CAN YOU EXPLAIN WHY THAT IS RIGHT?

It is true because OCT. can be an abbreviation for OCTAL as well as OCTOBER and DEC. can be an abbreviation for DECIMAL as well as DECEMBER.

The octal numbering system, used heavily in computing when code could be entered using switches on the computer front panel. The switches were in groups of three. An octal digit (base 8) runs from 0 to 7 or 000 to 111 binary. The octal number 31 in decimal is $3 \times 8 + 1$ or 25. Octal has largely gone away, being replaced by hexadecimal (base 16).

We had a lot of correct answers. Here they are in alphabetical order by call suffix:

AF6C Bob Eckweiler (Hey I had to solve it before I passed it on!)

AF6CF	Nicholas Haban	K6PGH	Doug Wood
KK6DWD	Ron Frank	N6TMT	Tim Millard
KI6E	Peter Putnam	KI6X	Dan Violette
K7JA	Chip Margell	KE6YHX	Corey Miller
WØMEC	Clem Brzoznowski	WA7ZZE	Chuck Penson
KD6NOT	Mark Bender		

RadioActivity

January 2019

DECEMBER

- **RAC Winter Contest:** 0000Z to 2359Z Sunday Dec. 29

JANUARY

- **Straight Key Night:** 0000Z – 2359Z January 1
- **ARRL RTTY Roundup:** 1800Z Saturday January 5 to 2400Z Sunday January 6
- **ARRL Kids Day:** 1800Z – 2359Z Sat. January 5
- ****North American QSO Party / CW:** 1800Z Saturday January 12 to 0559Z Sun. January 13
- ***ARRL January VHF Contest:** 1900 UTC Saturday Jan 19 to 0359 UTC Mon. January 21
- ****North American QSO Party / SSB:** 1800Z Saturday January 19 to 0559Z Sun. January 20
- ***CQ WW 160 Meter / CW:** 2200Z Saturday 25 Friday to 2200Z Sunday January 27

- ***Winter Field Day:**
1900Z Sat. Jan. 26 to 1900Z Sun. January 27
PLEASE JOIN THE CLUB EFFORT

* 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"

Repeating Activities:

- **Phone Fry** Every Tuesday night at 0230Z to 0300Z
- **SKCC** Weekend Sprintathon (Straight Key CW) on the first weekend of the month after the 6TH of the month. 1200Z Sat. to 2359Z Sunday.
- **SKCC** Sprint (Straight Key CW) 0000Z to 0200Z on the 4th Tuesday night (USA) of the month.
- **CWops** Every Wednesday 1300Z to 1400Z, 1900Z to 2000Z and Thursday 0300Z to 0400Z

Send an email to Ron W6WG, w6wg@w6ze.org to have your favorite activity or your recent RadioActivity listed in next month's column.

OCARC GENERAL MEETING MINUTES November 16, 2018

The OCARC General meeting was held at the Red Cross Complex in Santa Ana on November 16, 2018.

Attendance: We had 31 members, 2 guests and our guest speaker sign the attendance log.

The meeting was called to order at 7:05 pm and was followed by the Pledge of Allegiance to the Flag and introductions of the members and guests.

November Program:

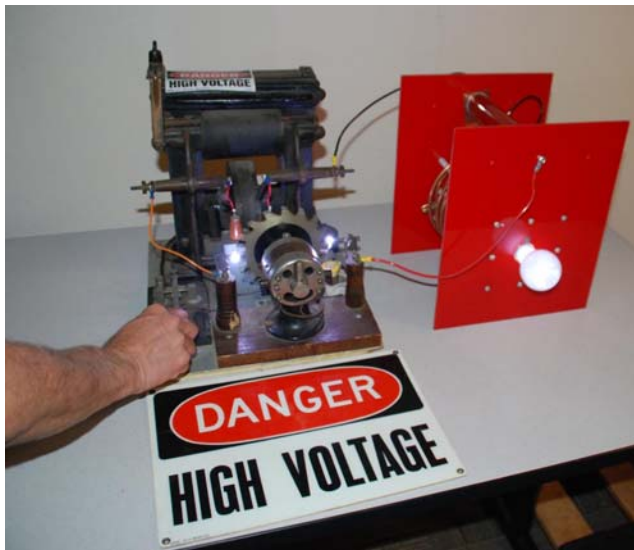
Dan, K16X introduced the presenter for the evening, John Stanford, KF6I. John's subject for the evening was the history and operation of early spark gap generator transmitters. He brought with him and demonstrated a rotary spark gap transmitter originally operated beginning in 1918 under the call 9YD. A native of Dayton, Ohio, John works full time as a self-employed EMC consultant. First licensed in 1974 as WN8SVN in Dayton, he holds an MSEE from the University of Illinois. John is an avid CW HF and VHF contester and active on 6M FT8. When not busy with his EMC clients, John runs his own Islands Amplifier Co repairing and restoring Alpha Amplifiers.

John began his presentation by discussing the history of radio transmission dating prior 1910 at which time transmitters were not subject to licensing and prior to the original Radio Act of 1912 which established a call letter system and Radio Inspectors. He spoke of the 1920's emergence of vacuum tube transmitters on board ships but continuing to be backed up by legacy spark gap shipboard stations.

John brought and demonstrated a spark gap transmitter built in 1914 using primarily \$50 worth of household derived parts and capable of an 800-mile range. The transmitter was actually operated under both the 9YD call sign and as a commercial weather broadcast station using the call sign of WCAJ.

During the intermission, John made the transmitter available for all present to experience hands on keying of their call on a 100-year-old transmitter. The transmitter arcing was impressive and a bit daunting to those who had never before experienced spark gap operation. The presentation was interesting, fun, and very well received.

Tim, N6GP reminded that information about the Holiday Dinner is available on the W6ZE website. Ken, W6HHC is available for payment at this meeting or from the PayPal link available on page 3 of the RF Newsletter.



Demonstration of the Ham Radio 9YD Rotary Spark-Gap Transmitter from 1918. The light bulb gets power from an six-turn inductor near the antenna tuning coil.



Professor Dr. John C. Jensen (center) is shown at the 9YD Ham Radio station at Nebraska Wesleyan University in approximately 1918. Steve Jensen W6RHM (current owner of the rotary spark-gap) is the grandson of Dr. J.C. Jensen 9YD.

Intermission was taken from 7:32 till 8:00pm.

Business Meeting:

Club Officers: There was a quorum. All officers were present with the exception of Ron W6WG and Kenan KR6J.

Election of Officers and Directors:

Jim, AF6N, as club secretary, conducted the election of the 2019 OCARC Officers and Directors. The Nominating Committee's slate for each position was presented and included a contest for President including Nicholas, AF6CF and Dan, KI6X. A secret ballot was taken and Dan, KI6X was elected. The Committee's slate listed two names for Member at Large. They were Tim, N6GP (Automatic as outgoing President) and Clem W0MEC. Nicholas, AF6CF was nominated from the floor, therefore requiring a secret ballot between him and Clem, W0MEC. The ballot was taken and Nicholas, AF6CF was elected.

No other committee slated positions were contested so they were elected by voice vote of the membership.

The elected 2019 OCARC Board of Directors will consist of:

President	– Dan Violette, KI6X	Membership	– Corey Miller, KE6YHX
Vice-President	– Tim Millard, N6TMT	Public Relations	– Vijay Anand, KM6IZO
Secretary	– Ken Konechy, W6HHC	Technical	– Bob Eckweiler, AF6C
Treasurer	– Greg Bohning, W6ATB	Director at Large	– Tim Goeppinger, N6GP
Activities	– Ron Mudry, W6WG	Director at Large	– Nicholas Haban, AF6CF

Announcements:

Arnie, N6HC gave a brief report on the successful Ducie Island DXpedition. Final count of contacts was approximately 120,000 including increasing popularity of FT8 operation. Arnie recommends our use of FT8 including Ver. 2.0 beginning in December. Arnie and Chip, K7JA will deliver a future lesson on use of Fox/Hound FT8. Arnie enthusiastically recommends the use of FT8 and also comments that 30 to 40 watts is really all that is required for successful contacts.

He also reported that the Braveheart crew was a great help, the Elecraft equipment performed flawlessly, and that only one operator was injured during site set up.

Chip, K7JA moved for a vote of thanks for the work of the outgoing Board especially for President Tim, N6GP. The motion passed and was unanimously approved.

Tim, N6GP announced that during the past month five new ARRL Directors have been elected.

Tim reminded everyone that Winter Field Day is coming up on the fourth weekend in January at the Ocean View School District Office site located at 17200 Pinehurst Lane in Huntington Beach. With the inclusion of the ABC group we hope to field 5 transmitters this year.

Tim reported the 2018 ARRL Field Day results. OCARC placed 2nd in the 7-transmitter category and 19th overall out of some 2900 entries.

Good of the Club:

Bob, AF6C reported our newest member, Keith, KM6WME emailed that both of his nephews lost their houses up state in the Camp Fire and Keith's brother has possibly lost his as well.

Jeff, KK6YUP reported that the local Red Cross has deployed few people to the Ventura/Malibu area fire due to local staffing needs.

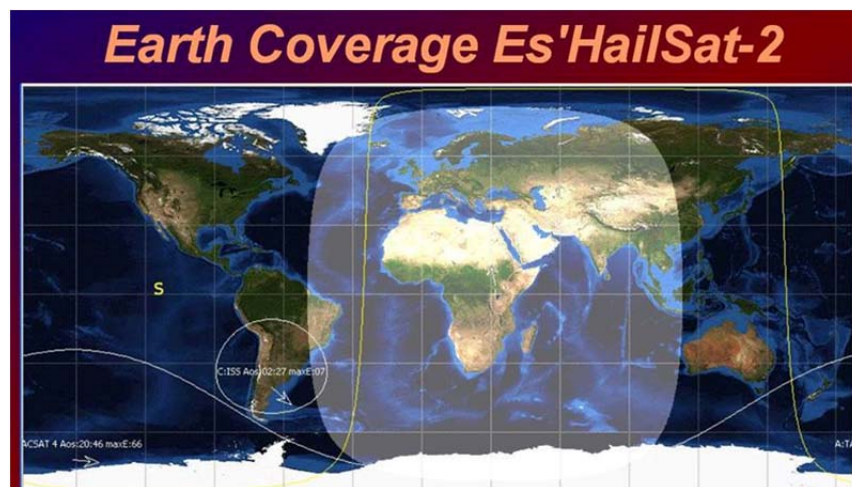
Meeting Adjourned at 8:58 pm

Submitted by Jim Schultz, AF6N
OCARC Secretary

Geostationary Es'Hail-2 Satellite with Ham Radio Digital-ATV Launched November 15, 2018 by Ken Konechy W6HHC

The Es'Hail-2 satellite on board a SpaceX Falcon 9 launch vehicle was launched from Cape Canaveral on 2018-11-15. From a concept proposed by the Qatar Amateur Radio Society, the Es'Hail (the Qatar Satellite Company) developed the geostationary Es'Hail-2 communications spacecraft that also provides two transponders (AMSAT Phase 4-A) for use by radio amateurs.

Es'Hail-2 will provide a 250 kHz linear transponder intended for conventional analog operations (CW, SSB, FM) in addition to another transponder which will have an 8 MHz bandwidth. The latter transponder is intended for experimental digital modulation schemes and DVB amateur television. Think of the wideband transponder as an 8 MHz-wide "bent-pipe". The technical design support of the two ham transponders is under the leadership of AMSAT-DL. The geostationary position will give coverage of Europe, Africa, Asia out to Thailand, and a piece of Brazil.



**Map of signal coverage for the two Ham Radio transponders
(courtesy of AMSAT-DL)**

Narrowband (250 KHz) Linear transponder

- 2400.050 2400.300 MHz Uplink
- 10489.550 10489.800 MHz Downlink

Wideband (8.0 MHz) Digital transponder

- 2401.500 2409.500 MHz Uplink
- 10491.000 10499.000 MHz Downlink

There is a YouTube video of the AMSAT-UK conference presentation on the ham radio DATV transponder given in July 2016 by Dave G8GKQ of the British Amateur Television Club (BATC).

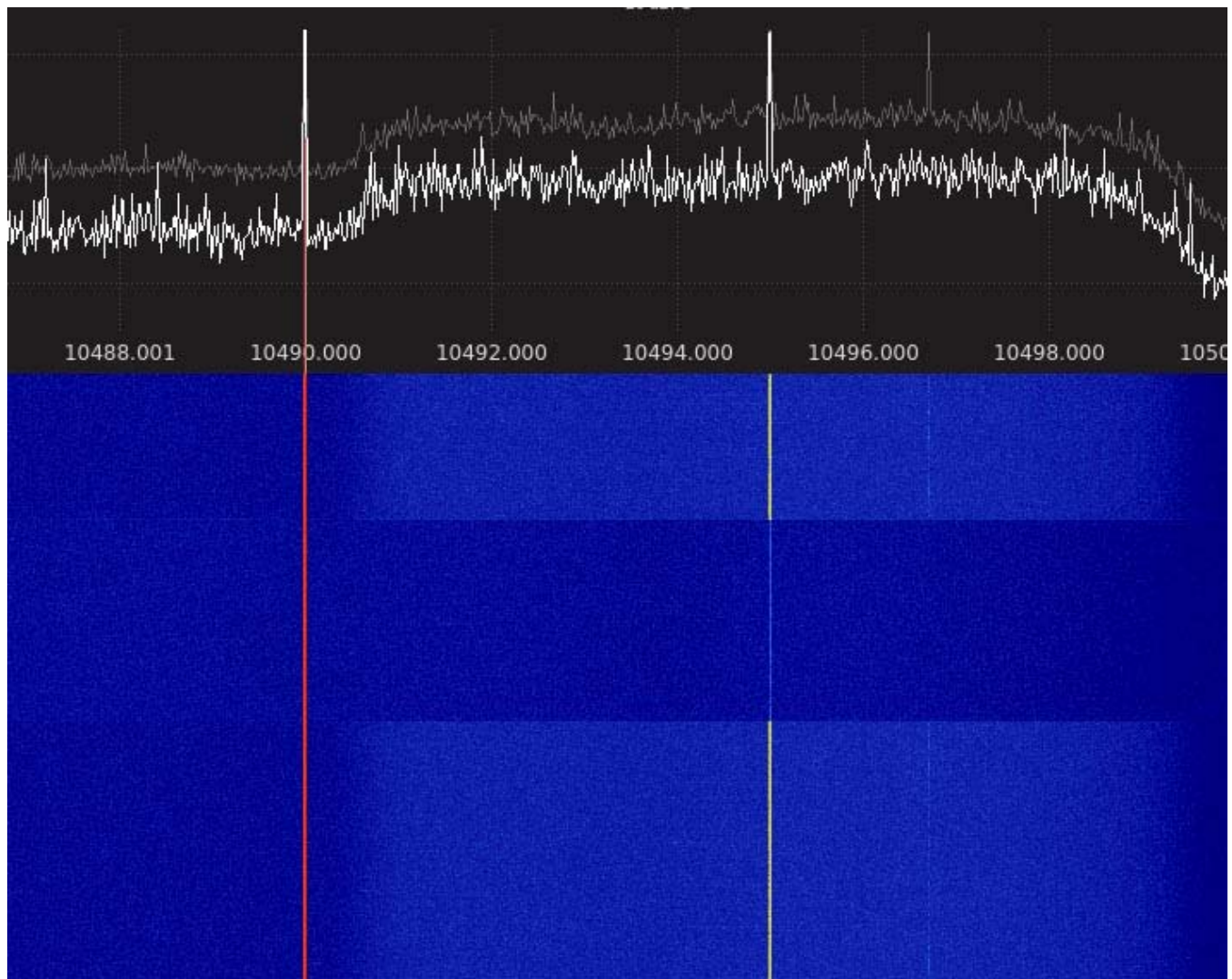
<https://www.youtube.com/watch?v=hnALEzG8rEQ&index=10&list=PLTDI7Ibh1cWoBqnxVSKlHFzZmCHcC2ZG2>

Also, a recent issue of the BATC magazine, CQTV (Issue No. 261 – Autumn), contains great articles about the Es'hail 2 communications satellite, including the proposed bandplan, and a useful 10 GHz LNB to consider for receiving the downlink ("across the pond", of course)

While this satellite coverage does not reach United States or any part of North America, Peter Guelzow DB2OS (President of AMSAT-DL) has explained that this ground breaking project is expected to provide an exciting new phase of activity for radio amateurs for the 21st century.

Noel G8GTZ of the BATC posted that the satellite has been positioned into a test orbital slot, and that the **In Orbit Testing** (IOT) procedures will take a few months to complete. During IOT, the ham radio payload will not be turned on.

Once IOT is complete...there will be an announcement by AMSAT-DL when the transponders are available for use. However, John GI7UGV reported on the BATC Forum (Forum.BATC.ORG.UK) that an interesting (but temporary) 8 MHz-wide signal on 10 GHz had been spotted on 2018-12-12.

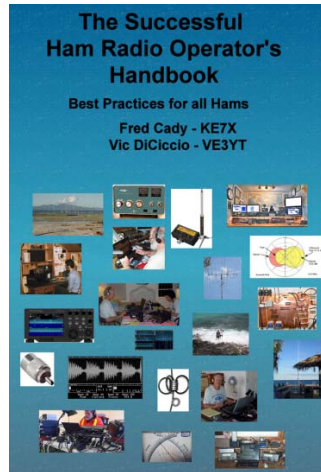


**An interesting horizontal polarized 8 MHz-wide signal captured by GI7UGV in the correct location of Es'Hail-2 satellite. The signal-gap in the middle was caused by switching the antenna to vertical polarization.
(courtesy of John GI7UGV and BATC Forum)**

Cash Flow - Year To Date

1/1/2018 through 12/15/2018

Category	1/1/2018- 12/15/2018
INFLOWS	
Auction In	2,073.75
Badge Income	2.00
Christmas Dinner Ticket Sales	1,041.97
Coffee Mug Sales	307.29
Donation	10.00
Dues, Family	50.00
Dues, Family (PayPal)	172.89
Dues, Membership	985.00
Dues, Membership (PayPal)	900.40
Field Day Food Income	422.00
Opportunity Drawing - Holiday	410.00
Opportunity Drawing -Monthly	375.00
Opportunity Drawing IN - Christmas	178.00
Opportunity Drawing IN - Christmas 2017	100.00
Refreshments Income	97.83
Troop 440 donation from KM6EMP	65.00
TOTAL INFLOWS	7,191.13
OUTFLOWS	
Anniversary Party Food	122.47
Auction Payout	1,812.38
Awards and Plaques	165.08
CA Statement Of Info filing	20.00
Christmas Dinner - Ladies Gifts	51.46
Christmas Dinner 2018 Meal Expenses	966.00
Club History Archive	56.24
Coffee Mug Expense	543.89
CU service Fee	20.00
Donation to Troop 440 - from Joel KM6EMP	65.00
Field Day - Flowers	53.88
Field Day - Gas	44.85
Field Day Equipment Repairs	49.48
Field Day Food Reinbursement	657.00
Insurance Expense	300.00
Meals - Board Mtg	12.48
OCARC Historian	122.45
Opportunity Drawing - Monthly	218.80
Opportunity Drwg - Christmas Radio	1,250.91
PO Box Rental	70.00
Postage	11.00
Publicity - OCARC Biz Cards	18.29
Refreshments Expense	96.01
Storage Locker	927.00
Supplies	24.33
Web Site Hosting	203.88
Web Site SSL Fee	69.99
TOTAL OUTFLOWS	7,952.87
OVERALL TOTAL	-761.74



The Successful Ham Radio Operator's Handbook

This new book is aimed at new or returning hams, to help them understand the practical aspects of the hobby, how to use their radios, build antennas and baluns, and get on the air successfully. In it you will find explanations of how the various parts of your ham radio - the transmitter and receiver – work, plus how these are being implemented using software defined radio technology. Operating techniques for VHF/UHF repeaters, HF radio DXing techniques, and the new digital modes are covered. Radio propagation, antennas, transmission lines, SWR and the mysteries of baluns are explained. Building your HF station, choosing a radio, connecting your radio to a computer, and mobile and portable operation are extensively covered.

Both the pdf and spiral-bound printed versions are available from Lulu.com, and the print copy is also sold by DX Engineering. You can find them via the links below:

<http://www.ke7x.com/successful/ordering-the-successful-ham-radio-operator-s-handbook>

Here is a link that describes the book in more detail:

<http://www.ke7x.com/successful>

Follow us on www.facebook.com/KE7XBOOKS to keep up-to-date on book news and to be notified of book discounts at www.lulu.com.

This book has 267 pages, 211 figures and diagrams, and 53 tables of data to make understanding the sometimes complicated ham radio operations much easier. The book follows KE7X's philosophy of presenting material in several forms to accommodate people with different learning styles -- reading, visualizing, hands-on -- with the many figures and text explanations and there are hands-on exercises throughout the book that can help you learn more about your particular radio.

Follow us on www.facebook.com/KE7XBOOKS to keep up-to-date on book news and to be notified of book discounts at www.lulu.com.

One instructor for new and advanced ham classes has said, "This book is exactly what is needed. I've seen some other books targeting the new hams that are less than satisfying both technically and in content but this one is right on the mark and covers so much information that I so often get asked about, during and after teaching classes."

Here are more details on the content:

- With nearly 110 years of ham radio experience between them, the authors are still excited about the challenges this wonderful hobby offers. *The Successful Ham Radio Operator's Handbook* will guide you when exploring some of these.
- Its goal is to help new operators and returning old-timers learn about the breadth of exciting ham radio activities and challenges available today.
- It answers the question "Why is ham radio relevant in the Internet age?"
- It covers a wide range of topics, helping the reader to understand the excitement of different facets of ham radio and to choose a challenging and exciting activity to pursue.
- It helps the reader better understand how the radio works. Many hams only use a small fraction of the features of their radio. For example, if you understand how a noise blanker or a roofing filter or the AGC works, you will be able to more easily use these, and other, features of your radio to your benefit.
- It provides exercises designed to apply the knowledge to cement your understanding of how your radio works without being radio-specific. It is good for all makes and models.
- It helps the reader get enough background to understand much of the jargon hams who pursue special activities, such as the various digital modes, VHF contesting and moon bounce. It quickly takes the novice reader to higher level of understanding and provides URLs and websites that help the reader go deeper into new interests.
- Antennas remain a key area where all hams can still successfully experiment and create a key part of their station. This book provides information to help new hams get started cutting their own verticals and dipoles. It explains why some popular multiband antennas may have compromises that impact performance.
- It gives practical guidelines about choosing transmission lines and building and using baluns and chokes.
- Digital modes such as RTTY, PSK and the new WSTJ modes are explained. The computer-to-radio connections needed for these modes are discussed and illustrated.
- Many hams are motivated by public service and emergency preparedness. This book describes typical local emergency organizations and national networks.
- Hams who like to operate while traveling will find practical information on reciprocal international agreements and how to get permission to operate legally.

HAPPY NEW YEAR 2019

MiniTiouner-Express

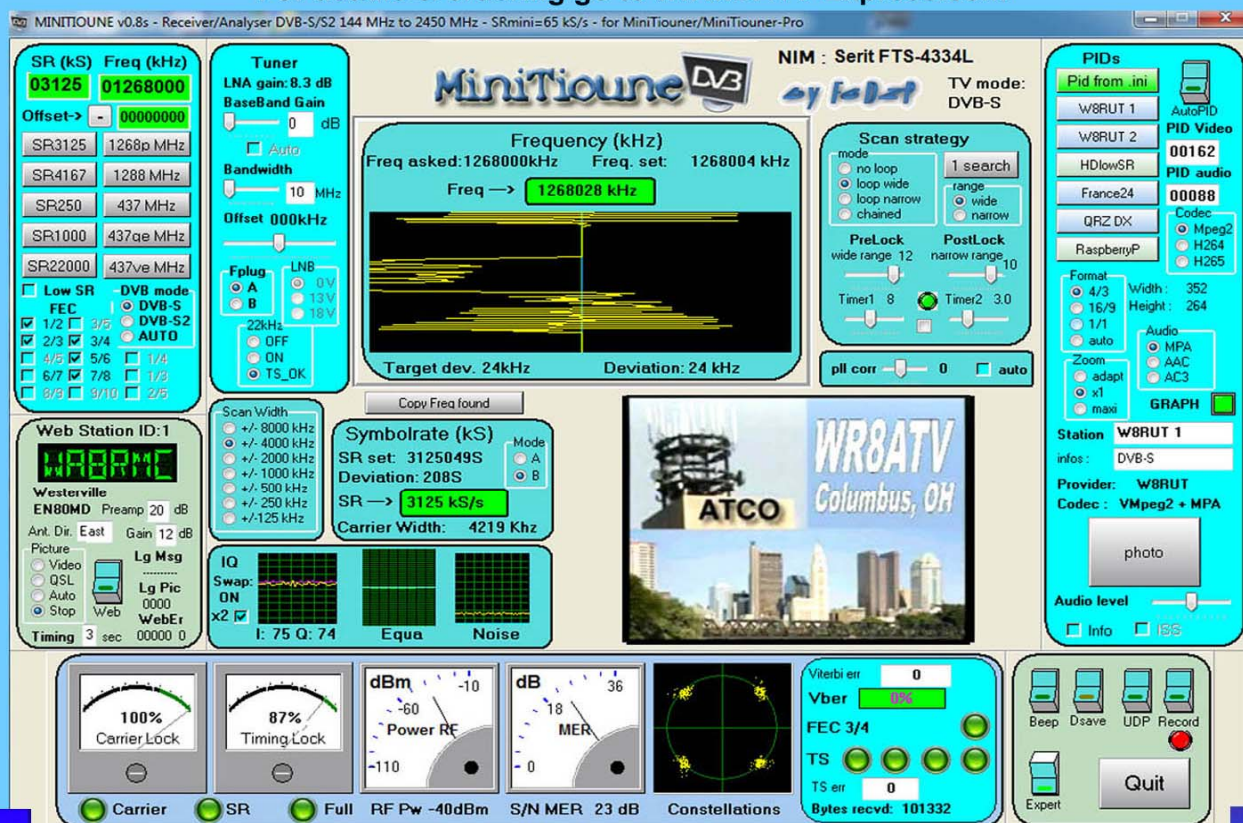
Digital Amateur Television DVB-S/S2 Receiver / Analyzer



Available at DATV-Express.com

- Operates with Windows PC using free MiniTioune software from Jean-Pierre F6DZP
- Smaller than a stack of 2 decks of cards (picture above is full size)
- Two independent simultaneous RF inputs with internal preamps
- High sensitivity -100dBm @1288MHz – at 1/2 FEC
- Fully assembled/tested in aluminum enclosure
- Covers 144-2420MHz (ideal for Space Station DATV reception)
- Symbol rates from 75 KSym/s to >20 MSymbols/sec
- Uses external 8-24VDC supply or +5V from USB-3 port (with small modification)
- Real time signal modulation constellation & dBm signal strength display
- Price: US \$75 + shipping – order with PayPal

For details & ordering go to www.DATV-Express.com



(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).