RF

ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LIII NO. 06 P.O. BOX 3454, TUSTIN, CA 92781-3454 June 2012

The Prez Sez.....

by Paul W6GMU

June is upon us and the WX is lovely! Just perfect for Field Day, I believe, which is almost upon us. Preparations are very much underway for our signature Club event, thanks to a sterling FD team!

All Field Day Band Captains are finalizing their plans for setup and operating schedules for their bands. This year FD should be a blast! I hope we'll achieve a good score, but the emphasis is on the enjoyment we experience by operating. We also gain practice conducting QSOs at a quick pace, which is a necessary skill to have during an emergency. Dee, our fearless FD czar is doing a truly fine job to craft one of our best FDs to date. Please contact her or any Board member should you need any further info. I hope y'all will support your Ham Alma Mater and attend - we'd <u>love</u> to see you there for ANY length of time!

I'll see you at the Meeting and remember:

FD->>> Forward Ho!!!,

73 de Paul W6GMU
The "Prez"

Next Meeting

Our General Meeting will be held on June 15th, featuring our very own Ken W6HHC and Bob, AF6C, the Club Webmasters delivering a long-awaited presentation on:

"Discovering the OCARC Web Site contents"

The next general meeting will be on:

Friday, June 15th
@ 7:00 PM

As usual, we will be meeting in the east Red Cross Building, Room 208. See you there!

In This Issue: Page

ORANGE COUNTY AMATEUR RADIO CLUB
www.W6ZE.org

2012 Board of Directors:

President:
Paul Gussow, W6GMU
(714) 624-1717
w6gmu@w6ze.org

Vice President:
Robbie Robinson, KB6CJZ
(714) 978-8049
KB6CJZ@w6ze.org

Secretary:
Ken Konechy, W6HHC
(714) 744-0217
w6hhc@w6ze.org

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

Membership:
Jeff Hall, W6UX
(949) 697-9279
W6UX@w6ze.org

Activities:
Doug Britton, W6FKX
(714) 742-2459
w6fkx@w6ze.org

Publicity:
Tim Goeppinger, K6GEP
(714) 730-0395
k6gep@w6ze.org

Technical:
John Roberts Jr, W6JOR
(714) 540-9148
w6jor@w6ze.org

Directors-At-Large:

Kristin Dankert, K6PEQ
(714) 544-9846
k6peq@w6ze.org

Nicholas Haban, AF6CF
(714) 693-9778
af6cf@w6ze.org

2011 Club Appointments:

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

Club Historian:
Bob Evans, WB6IXN
(714) 543-9111
WB6IXN@w6ze.org

RF Editor (rotating):
Nicholas Haban, AF6CF
(714) 693-9778
af6cf@w6ze.org

WEB Master:
Ken Konechy, W6HHC
(714) 744-0217
W6HHC@w6ze.org

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

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

Larry Beilin, K6VDP
(714) 557-7217
K6VDP@aol.com

OCCARO Delegate:
Paul Gussow, W6GMU
(714) 624-1717
W6GMU@W6ZE.org

Monthly Events:

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

Club Breakfast:
Second Saturday of every
month at 8:00 AM
Jagerhaus Restaurant
2525 E. Ball Road
(Ball exit off 57-Freeway)
Anaheim, CA

Club Nets (Listen for **W6ZE**):
28.375 ± MHz SSB
Wed- 7:30 PM - 8:30 PM
Bob AF6C, Net Control

146.55 MHz Simplex FM
Wed- 8:30 PM - 9:30 PM
Bob, WB6IXN, Net Control

7.086 ± MHz CW **OCWN**
Sun- 9:00 AM – 10 AM
John WA6RND, Net Control

VISIT OUR WEB SITE

http://www.w6ze.org

for up-to-the-minute club information, the latest membership rosters, special activities, back issues of RF, links to ham-related sites, vendors and manufacturers, pictures of club events and much much more.

Club Dues:

Regular Members	...$20
Family Members*	...$10
Teenage Members	..$10
Club Badge**	…….$3

Dues run from Jan thru Dec and are prorated for new members.

*Additional members in the family of a regular member pay the family rate up to $30 per family.

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

From: ARRL Web site [mailto:memberlist@www.arrl.org]
Sent: Wednesday, May 23, 2012 9:46 AM
Subject: June 2012 QST - Digital Edition

June 2012 QST - Digital Edition - Go Now>

Dear ARRL Member,

In addition to the print edition of *QST*, all ARRL members have access to the convenient, new digital edition of *QST* at no additional cost. The current edition of *QST* is available now: June 2012 *QST*

Special ARRL Field Day Issue/First Digital Edition...

- ARRL COO Harold Kramer, WJ1B provides background on the new digital edition
- A telescoping multiband vertical whip for Field Day (or any other day)
- Plan ahead to avoid Field Day mishaps
- The first South Sudan (STØ) DXpedition
- ...and more!

Digital-Only Features...

- Video from President Kay Craigie, N3KN introducing the first digital edition
- Video overview of the portable generators reviewed in this issue
- Review of the new ham-centric mystery novel by Ward Silver, NØAX
- Video example of a 43 foot vertical antenna installation with a remote tuner for multiband use
- ...and more!

Every issue of *QST* is filled with the news and features you need to keep active in Amateur Radio. After you read through it, visit the Digital *QST* Feedback Form and tell us what you enjoyed!

73,
Steve Ford, WB8IMY Editor

OCARC Field Day Planning

by Dee N8UZE

Field Day is a major event in the amateur radio community. Although it may not be possible to commit for the entire event, even a half an hour of your help is helpful. So please sign up at the upcoming meetings. Our category and the number and type of antenna installations will depend on how many volunteer to help. We need more people to help with setup and teardown. Additional operators are needed so that no one gets too worn out. The following list is a summary of the current status.

- **Band Captains** (We also would like commitments for additional bands - 80, 15, 10, VHF, UHF. Bands can be combined such as an 80/10 station)
  - 20 meter CW – Paul, W6GMU
  - 20 meter PH – Ken, W6HHC and Bob, AF6C
  - 40 meter All – Tim, K6GEP and Doug, W6FKX
  - 80/10 meter All – Nick, KD6IPE (supported by Dee, N8UZE)
  - GOTA – Brett, W6BAC
  - Satellite – Jay, KI6WZU
  - VHF/UHF – Robbie, KB6CJZ

- **Bonus Point Volunteers**
  - Media Publicity – Tim, N6GP
  - W1AW message – Jeff, W6UX
  - Natural Power – Nicholas, AF6CF
  - Visit by elected official – Jeff, W6UX will look into
  - Educational Activity – Bob, AF6C

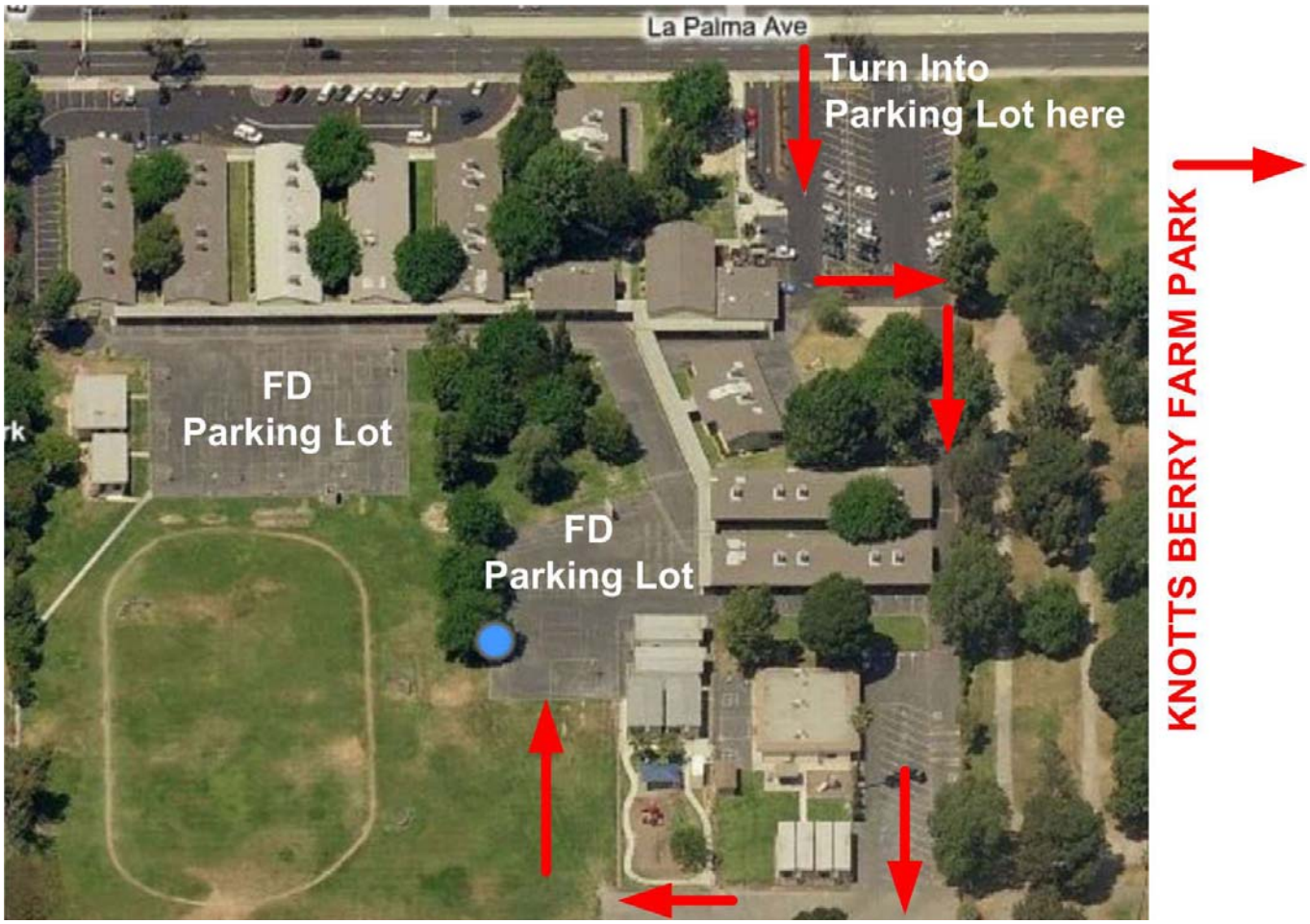
- **Other volunteers** (we need many more volunteers in these areas)
  - Operators – 8in addition to band captains
  - Setup – 16
  - Teardown – 12

OCARC Field Day Location Map

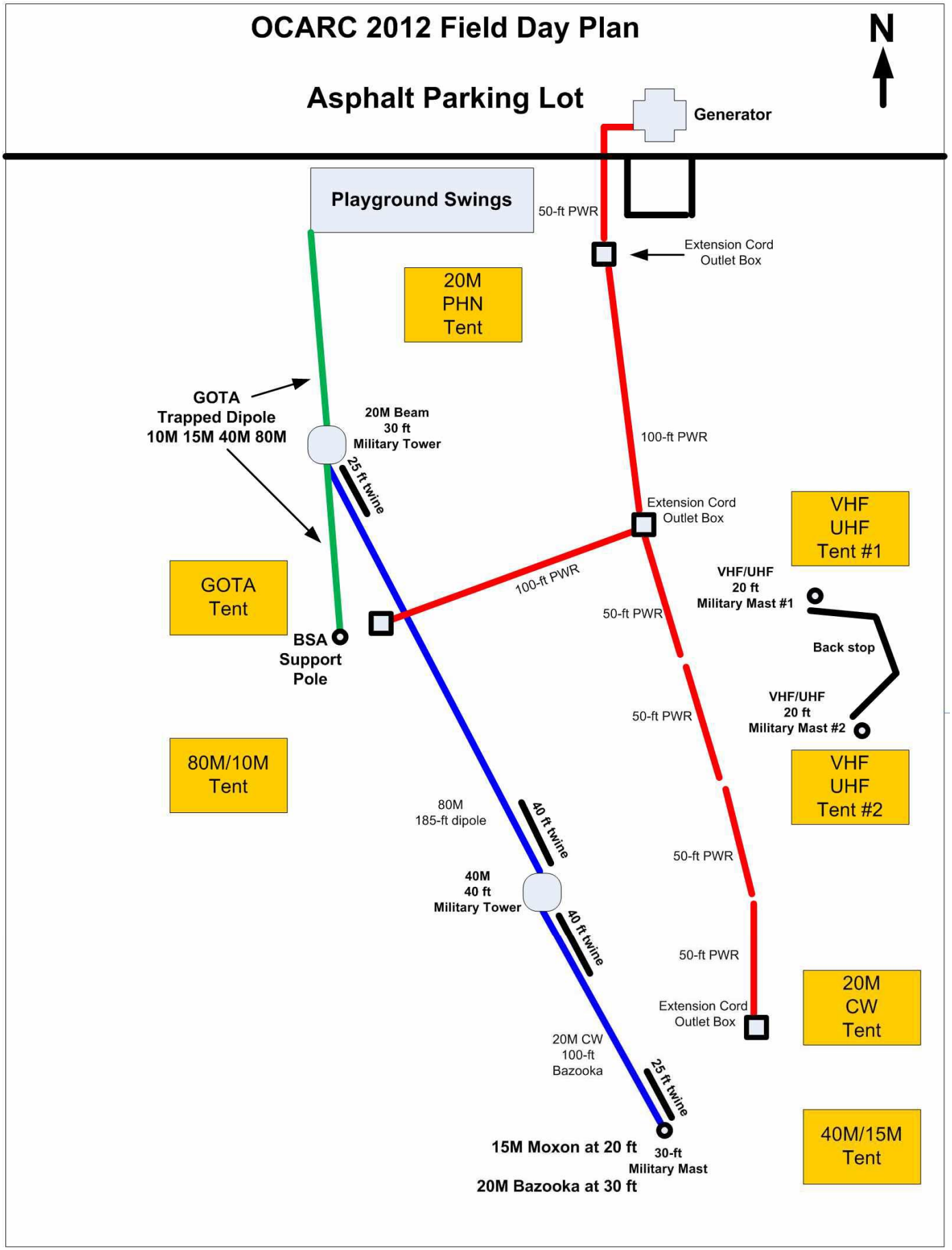
Field Day will be again at last year's site,(Ex Walter Knott Elementary School); however this year the access to the field is slightly different. You may have to drive on a grassy area to reach the Field Day parking lot.

See aerial picture below for more details.

7300 La Palma Ave Buena Park, CA 90620



- **Head for Knott's Berry Farm**
- **Take the Beach Blvd (south) exit from the 91 or 5 FWY**
- **Turn right (west) on La Palma Ave, along the north edge of Knott's Berry Farm Park.**
- **Continue driving on La Palma, past the Knott's Berry Park to 7300 La Palma Ave.**
- **The school will be on your left on the south side of La Palma. Use the first entrance on the East side of the school buildings.**


OCARC 2012 Field Day Plan
N
Asphalt Parking Lot
Generator
Playground Swings
50-ft PWR
Extension Cord
Outlet Box
20M
PHN
Tent
GOTA
Trapped Dipole
10M 15M 40M 80M
20M Beam
30 ft
Military Tower
25 ft twine
100-ft PWR
Extension Cord
Outlet Box
VHF
UHF
Tent #1
GOTA
Tent
100-ft PWR
VHF/UHF
20 ft
Military Mast #1
50-ft PWR
Back stop
BSA
Support
Pole
VHF/UHF
20 ft
Military Mast #2
50-ft PWR
80M/10M
Tent
VHF
UHF
Tent #2
80M
185-ft dipole
40 ft twine
50-ft PWR
40M
40 ft
Military Tower
40 ft twine
50-ft PWR
20M
CW
Tent
Extension Cord
Outlet Box
20M CW
100-ft
Bazooka
25 ft twine
40M/15M
Tent
15M Moxon at 20 ft
30-ft
Military Mast
20M Bazooka at 30 ft

Heathkit of the Month #40:
by Bob Eckweiler, AF6C

Heathkit HP-13/13A/13B and Related Mobile Power Supplies.

Introduction:

Hams like to operate their radios mobile. While today's solid state radios often run natively off of 12 volt power (actually nominally 13.8 volts), earlier tube radios require higher voltages to operate. To facilitate mobile operation with these earlier radios Heathkit manufactured a line of DC-DC power supplies that convert the battery voltage in a car to the higher B+ and bias voltages required by a tube-type radio.

In Heathkit of the Month #26 (February 2011 issue of RF) The AC line powered HP-23 series of power supplies, their predecessors and successor were discussed. This article will look at the mobile versions of these power supplies in the same manner.

The most popular of the Heathkit DC power supplies is the HP-13 (Fig. 1) which went through two updates during its lifetime designated the HP-13A and HP-13B. This power supply was built specifically for the Heathkit SB and HW mobile lines such as the SB-100 and HW-100 series. For earlier mobile radios like the MT-1/MR-1 twins and the HX-20/HR-20 twins Heathkit manufactured the MP-1 and HP-10 mobile power supplies. Heathkit also manufactured the GP-11 mobile power supply for the Lunchbox series of transceivers popular in the 1960's and the HP-14 that powered the HA-14 "Kompact" Kilowatt.

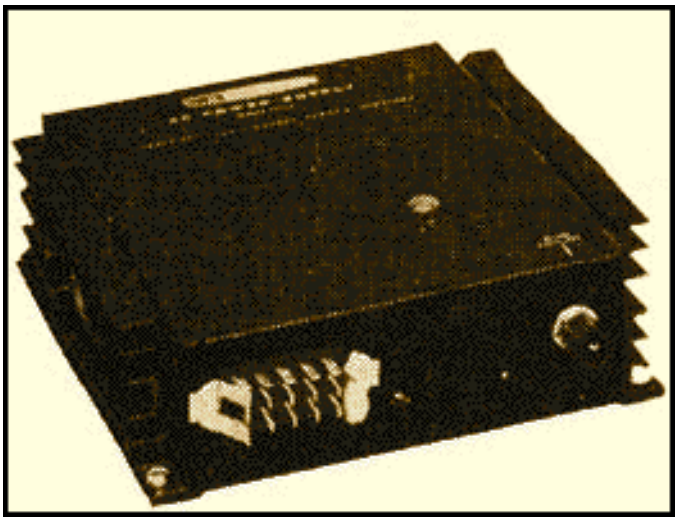


Figure 1: Heathkit HP-13 Mobile Power Supply

The Heathkit GP-11 Vibrator Power Supply:

Of all the power supplies covered in this article only the GP-11 uses a vibrator to convert DC into AC to be stepped up by a transformer and rectified into a higher voltage. The GP-11 output is 250 VDC at 100 ma ICAS (Intermittent Commercial and Amateur Service). It uses a Mallory 1610 vibrator which is long obsolete. Since vibrators contain dampening rubber that deteriorates with age, very few of these devices still have mechanical vibrators that work. Luckily there are solid-state vibrator replacements available, though they are rather expensive due to their small market base. The 1610 vibrates at nominally 115 cps (cycles per second).

Figure 2: Heathkit GP-11 Vibrator Power Supply

The GP-11 (Fig. 2) weighs five pounds and can be wired to run on either 6 volts (@ 6.5A) or 12 volts (@ 3A) at full load. Maximum input voltage is 8 or 16 volts. The secondary of the trans-

former utilizes a full-wave voltage-doubling silicon diode rectifier circuit.

Measuring 4-5/8" H x 6-1/2" W x 4-1/8" D the GP-11 was small for its day and easily fit in cars and trucks. It is painted in a gray and green motif with a ventilated cover protecting the vibrator and transformer. Three terminals under the cover are for B+, Ground and Input Power.

The GP-11 sold for $16.88 in 1965. It was manufactured from 1963 through 1969.

The Heathkit MP-1 Mobile Power Supply:
The first transistorized power supply Heath manufactured to power a radio was the MP-1 (Fig 3) . This was the DC equivalent of the AC line powered UT-1 that was manufactured to power the MT-1 Cheyenne and the MR-1 Comanche twins (See Heathkit of the Month #10 from the November 2008 issue of RF). The MP-1 measures 7" H x 9-1/16" W x 4-3/4" D. It was produced for one year - 1960.

The MP-1 uses a pair of 2N442 germanium power transistors switching at a nominal 400 Hz to provide the 600V DC and 300 VDC power needed to run the MT-1 / MR-1; the radio filaments run directly from the 12V supply. The MP-1 can supply 120 watts of DC power continuously and up to 150 watts intermittently. Input and output is via a six-pin Jones plug:

Pin #	Function:
1.	300 VDC @ 100 ma*
2.	600 VDC @ 200 ma*
3.	Ground
4.	On/Off Relay
5.	Filament 12 volts
6.	Filament Return (Ground)

* Maximum combined output power is 120 W CCS or 150 W ICAS

The Heathkit HP-10 Mobile Power Supply.
The MP-1 was replaced with the HP-10. The HP-10 supplies similar voltages to the MP-1, but also provides negative bias power. This was

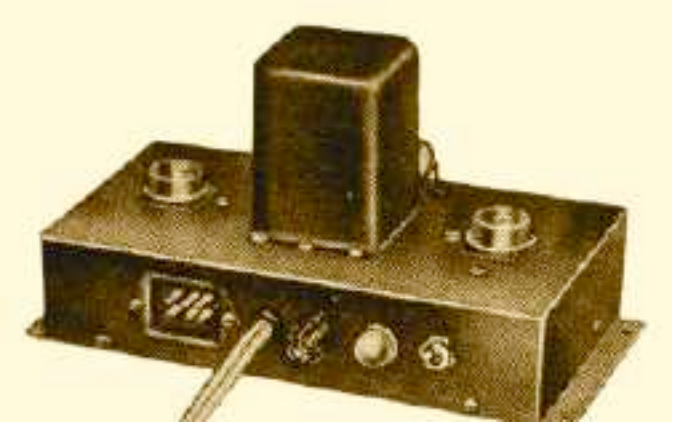


Figure 3: Heathkit MP-1 Transistorized Power Supply

needed to power the soon to be released HX-20 and HR-20 mobile twins. (See Heathkit of the Month #11 from the December 2008 issue of RF). The HP-10 also works well with the earlier MT-1 and MR-1. Besides providing the same high and medium voltages as the MP-1 it also provides a negative 130 volts at up to 30 ma for bias requirements. The relatively expensive Jones plug used in the MP-1 was replaced with an octal socket:

Pin #	Function:
1.	-130 VDC @ 30 ma
2.	Ground for bias and B+
3.	300 VDC @ 100 ma*
4.	600 VDC @ 200 ma*
5.	Spare
6.	Filament
7.	Filament Return (Ground)
8.	On/Off Relay

* Maximum combined output power is 120 W CCS or 150 W ICAS

The HP-10 uses two germanium 2N1147 switching transistors that are hard to find replacements for in today's market. It stayed on the market into 1963 when it was replaced by the HP-13 designed for the new SB-100 SSB Transceiver.

The Heathkit HP-13 Mobile Power Supply:
The HP-13 was released in 1963. It provides higher B+ voltage and current for the transmitting tubes, 750 VDC @ 150 ma CCS (continuous commercial service) and 300 ma ICAS. The

lower voltage can be selected internally at either 300 VDC or 250 VDC at up to 175 ma CCS. The bias supply can be adjusted internally from -40 to -130 VDC at up to 20 ma.

The transformer used in the HP-13 is toroid wound and switches at a frequency of ~1,500 cps. The switching transistors are germanium PNP and are identified only by their Heathkit 417-60 part number and a manufacturer's part number SP838. They are rated as 45V, 25A, 100W.

The HP-13 goes back to using a Jones plug, probably for its high current handling capability. This is a fifteen pin plug and handles both output to the radio and input from the automobile battery system. To handle the high current the 12 VDC and ground lines each use four paralleled terminals. An internal 12 VDC relay switches power to the filament pin as well as to the internal power. The relay coil terminals are available on pins 6 and 7 of the plug. Two circuit breakers provide input protection (30 amp) and filament protection (6 amp).

Pin #	Function:
1.	+12 VDC input*
2.	+12 VDC input*
3.	250/300 VDC @ 175 ma CCS**
4.	+12 VDC input*
5.	+12 VDC input*
6.	Relay coil (isolated from ground)
7.	Relay coil return (isolated from gnd.)
8.	+12 VDC output to filaments
9.	_40 to -130 VDC bias @ 20 ma***
10.	12 VDC return (Ground)****
11.	12 VDC return (Ground)****
12.	not used
13.	12 VDC return (Ground)****
14.	12 VDC return (Ground)****
15.	+750 VDC @ 150 ma CCS @ 300 ma ICAS

* Pins 1, 2, 4, 5 are internally connected
** Voltage selected internally by tap.
*** 20 ma @ -130V to 1 ma @ -40V CCS
**** Pins 10, 11, 13, 14 are internally connected

During the production run the HP-13 underwent a small parts change. The bias potentiometer was changed from part # 10-73 (20KΩ) to part number 11-81 (15KΩ), and the plastic guard control for the bias pot was changed from part # 252-20 to 440-11. These changes were introduced in a letter dated 11/18/1966.

The HP-13 is 2-3/8" H x 7-3/4" W x 7-5/16" D and weighs 5-1/4 pounds. Input power is 12 to 14.5 VDC at up to 25 amperes under full load. It's operating temperature range is from -10°F to 122° F. It sold mail order for $59.95 in 1965. Fiure. 5 shows the HP-13 schematic.

The Heathkit HP-13A

In mid 1969 the HP-13 was replaced by the HP-13A. This unit is physically similar to the original HP-13 with three significant changes. The power transistors were changed, the collector to base resistors were changed from 270Ω 2-watt carbon resistors to heavier 210Ω 5-watt resistors and the filament circuit breaker was changed from 6 amperes to 10 amperes. The new power transistors are Heathkit part #417-120, believed to have a manufacturer's part number of DTG110B. This transistor was capable of higher voltage and allowing the power supply input voltage rating to increase from 14.5 V to 16 V, a significant increase in safety margin.

The HP-13A sold from mid 1969 to 1973 when it was replaced by the HP-13B. In 1969 the HP-13A sold for $65.95.

The Heathkit HP-13B:

The HB-13B (Fig. 4) is a further refinement of the HP-13A. The circuit has been changed to improve starting and add protection to the power transistors. The bias voltage is now fixed and heavier wiring is used in the filament cable to reduce voltage drop. The fixed bias is set at -130 VDC @ 20 ma. The HP-13B stayed in production until Heathkit replaced its mobile transceivers with transistorized radios. The last units were produced in 1979. In 1973 the HP-13B sold for $69.95 and later in 1977 for $84.95.

Figure 4: Heathkit HP-13B from 1973 Catalog

Heathkit HP-14 Mobile Amplifier Power Supply:

Finally, there is another mobile power supply Heathkit manufactured. It supports their "Kompact Kilowatt" Model HA-14. Yes, it powers a 1 KW PEP mobile amplifier using a pair of 572B tubes, just like the SB-200. This power supply produces 2,000 VDC @ 170 ma and 500 ma peak. Input voltage is 12 to 14.5 VDC (and later 12 to 16 VDC); average current during transmitting is 25 amperes with a peak of 50 amperes, depending on the signal driving the amplifier. It also supplies -110 VDC at 60 ma bias and -6 VDC for ALC bias.

Heathkit came out with a service bulletin in May 1966 for the HP-14 recommending replacing both R1 and R3 with 125Ω 10 W resistors and the four transistors from Heathkit part# 417-60 to 417-120; both must be done.

The HP-14 has the same temperature rating as the HP-13; it measures 2-5/8" H x 8-3/8" W x 7-3/4" D and weighs 8 pounds

These power supplies have driven many radios over the years in a mobile environment. Still today, many are in use.

Until next month...

73, from AF6C

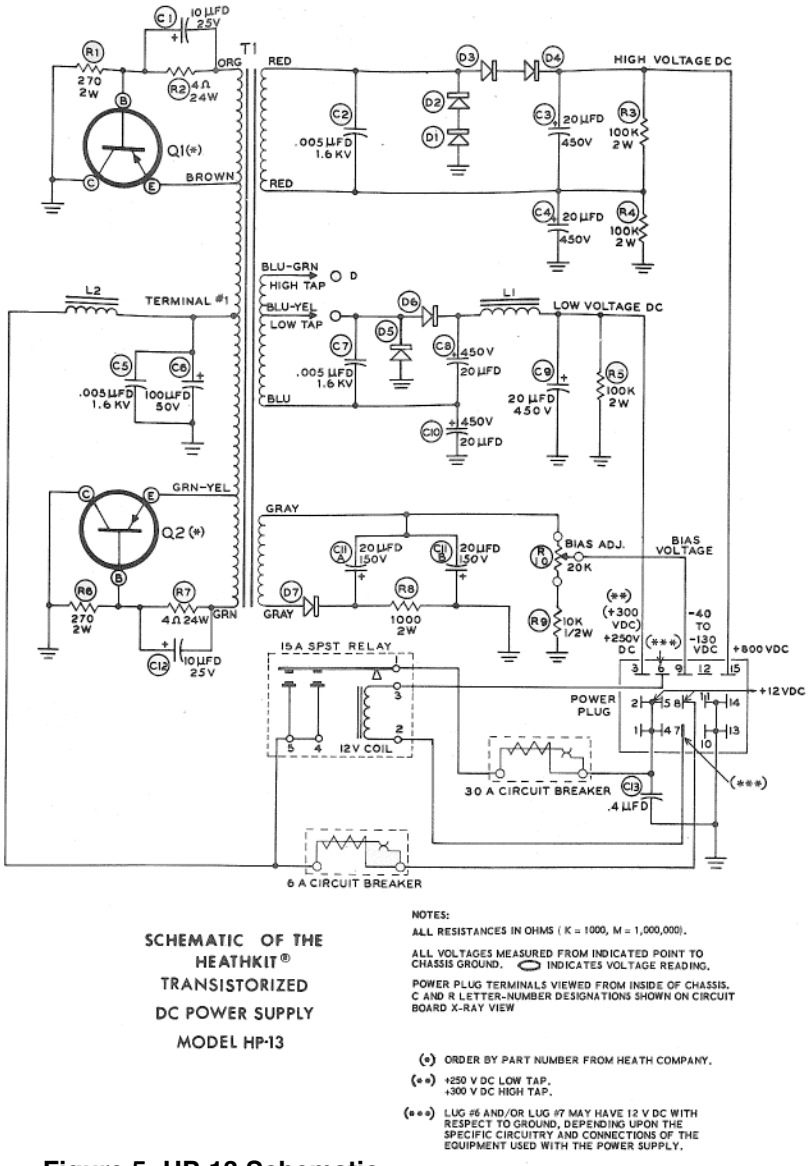


Figure 5: HP-13 Schematic

You are invited…

To Explore the World of VHF Contesting – June 9th

June and July is peak Sporadic E propagation season on 6 meters, and there is no better way to take advantage of it is the ARRL VHF June QSO Party. With hundreds of ops on the bands, anything can happen!

I will be entering the ARRL VHF June QSO party as a multi-op rover, and I am extending an invitation to OCARC members to join me at either of the local hilltops where I will be operating from. As a multi-op, I can let you operate the rigs.

A rover is required to put at least 2 grids on the air. Many of you know that most of us live in grid DM13 which stretches from around the 22 and Goldenwest to Palm Springs in the east, and the 60 freeway on the north, to Escondido on the south. Members living west of Goldenwest are in grid DM03.

My entry will also be in the limited class, which means I only use 6 and 2 meters, 220 MHz and 440 Mhz. My van will have a very improvised setup with antennas on fruit picking poles on patio umbrella bases. Conversely, our local Pack Rovers, will be using 10 VHF/UHF bands from 6 meters to 10 GHz with professional looking mobiles that resemble some sort of news vans.

Southern Calif Pack Rovers

Why is roving in a VHF Contest fun?

1. You get outside the 4 walls of your shack, see some local sights, and meet some curious people who ask “What are you doing with all of these crazy antennas?”
2. Maybe you live in a neighborhood with antenna restrictions. This is your chance to be a “big gun”. Imagine having a 4 element yagi up 2 wavelengths on top of an 1100 foot hill. Try doing that on 40 meters!
3. Experience a thrill when there is a band opening, and the band goes nuts!
4. When you move to a new grid square, you get to work everyone all over again.
5. The contest isn’t an emergency scenario, but you learn skills and gather equipment that might be useful in an emergency.

Where and when?
Saturday June 9th

Site #1 - Grid DM13 – Coastal Peak Park, Newport Beach 11:30AM – 1:00PM (11AM to see the Pack Rovers)
http://goo.gl/maps/T0r6 **(Google Map)**

This is a beautiful location that has nice views in about 270 degrees. Due to OCARC board meeting, I won’t be there until 11:30, but don’t miss the Pack Rovers at 11AM. They will be very busy doing their runs of 10 bands x number of vehicles, so not too much time for eyeball QSOs.

Directions (does not use Toll Road):
From the 55S or 405, take the 73 south.
Exit at MacArthur (14A) and go south 2 miles
Turn Left on San Joaquin Hills Road, and go 2.5 miles

Turn Right onto Ridge Park Rd, and take it 1.5 miles to the top where you will see many cars a and baseball fields etc. I am NOT at the county microwave towers site. I will be near the intersection of Ridge Park Road and E Coastal Peak if parking allows.

Site #2 - Grid DM03 – Near 2637 Panorama Dr, Signal Hill 2:00PM – 3:30PM
http://goo.gl/maps/7g4m (Google Map)

This location has a great view of Long Beach Airport, with good views to the north and east. If we are lucky, we will have an eyeball QSO with Hans, N6TCZ.

Directions :
Take either the 22 or the 405 to the point where they merge into the 405 in Seal Beach.
Exit at Cherry Ave. S – Signal Hill (29A)
Keep left at fork, and follow signs to Temple Avenue.
Turn Left on Temple Avenue
Turn Right onto Willow St.
Turn Left on Cherry Ave.
After the Home Depot, turn Left onto Skyline Dr
Keep going on Skyline Dr over the top of the hill to the east side. Many stop signs.
Turn left onto Panorama Dr (one way street) and you should see me and/or the Pack Rovers.

Past Results
Have done about 3 VHF contests from these hilltops last year, and had a blast. From Signal Peak in Newport Beach, I have worked Montana and XE2HWB way down in DL44 in La Paz on 6 meters. In Sept. there was a tropo opening on 2 meters to the Central Calif coast, and to the Fresno Area.
Last year's visit to Signal Hill gave me the opportunity to work one of the best openings of the year on 6 meters. The band exploded with SSB and CW signals. I worked Ontario Canada, Michigan and Virginia. It was a memorable event!

*Disclaimer – Past performance may not be indicative of future results – but that is why it is called an adventure.

If you need directions, please call me at my cell – 714-875-2344 Hope to see you on one of the hilltops!

Tim N6GP

Resources:

VHF Contest Rules	http://www.arrl.org/june-vhf-qso-party
Grids on Google maps	http://www.levinecentral.com/ham/grid_square.php
So California Pack Rovers	http://packrovers.com/

OCCARO News

By KC6TOD

Here is an opportunity for the local clubs/groups to really represent Amateur Radio & Emergency Communications in a very public experience. It does not cost anything. Can your club/group step up to the plate and present at the "PREPPERS FAIR"? Let's show them what we can do! Contact Carl Gardenias WU6D and offer to participate.

Be Ready Inc. would like to invite you to it's first annual Preppers Fair, June 30, 2012 in the parking lot of their store location in Oceanside, CA.
Be Ready, Inc. has asked that Amateur Radio be part of what it plans to be a growing annual fair on preparing yourself for an emergency.

Steve Early, AD6VI (San Diego Section Manager), & Carl Gardenias, WU6D (Orange Section Manager), were contacted to assist in the initial planning of this event as Be Ready, Inc., has stores in both San Diego and Riverside Counties. In the years to come, Be Ready, Inc. will make all future arrangements.

For vendors: A 15 x 15 space will be provided
Note: Vendors will be responsible for bringing their own table, chair and pop up and any materials for their display.

Amateur Radio speaker's presentations must be related to emergency preparedness. Presentations are to be 30 minutes with a 15 min. Q & A session.

Set up at 6am
Fair runs from 9am – 3 pm
Lunch will be served at a minimal price
Music will be provided during the lunch hour

Please visit the Be Ready website, www.bereadyinc. com, for further information about the company. A flyer for this great upcoming event is available at: http://bereadyinc. squarespace. com/storage/ Prepper Fair.pdf

Please Contact:

Carl Gardenias WU6D
951 490.2270

Adam Cabacungan
VP Operations of Be Ready Inc.
800 800.7922

TechTalk#101

DATV – Looking at a "Slot" Antenna for 1.2 GHz

by Ken Konechy W6HHC

I have been occasionally running into "slot antenna" discussions ever since I got interested in Digital-ATV. I decided to take a closer look at the slot antenna design, try to understand how it works, and see if the slot antenna might be might be the best approach for me on 1.2 GHz. This article is intended to explain concepts on how the slot antenna works and allow you to compare it to other antenna designs. This article is an overview and will not teach you the details that you need to actually build one. If you are interested in building one, there are plenty of design and construction articles available on the web.

Microwave Waveguides

The heart of the basic slot antenna is the use of microwave Waveguide for construction. In ham radio, I managed to avoid working with waveguides by working mostly with frequencies of 440 MHz and down…where coax cable had acceptable performance. So I need to start by explaining "what is a waveguide". A microwave waveguide is a very low loss transmission line for RF at microwave frequencies. A waveguide model called WR-90 creates about 0.1 dB of loss per meter as transmission line at a frequency of 10 GHz. Compare that loss with Beldon 9913 coax at about 0.62 dB/M loss at 10 GHz and 0.17 dB/M loss at 1.3 GHz…or LMR-400 coax at about 0.50 dB/M loss at 10GHz and 0.16 dB/M at 1.3 GHz.

In general, a waveguide consists of a rigid hollow metallic tube. Common waveguide shapes are rectangular, square, circular, and ridged. A very typical waveguide for the X-Band (frequency range of 8.2 to 12.4 GHz) is the USA standard rectangular waveguide, model WR-90, that has an inner width dimension of 0.9 inches (2.286 cm) and an inner depth of 0.4 inches (1.016 cm). Different models of waveguide operate in different frequency ranges. Most models of waveguides use different dimensions and operate above 5 GHz. A few models like WR-650 (6.50 in x 3.25 in) will work at 1.2 GHz

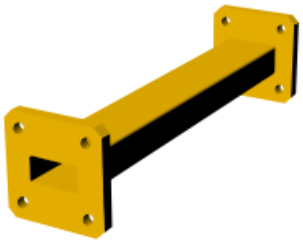


Figure 1 – A short Section of Rectangular Waveguide with Flanges for connecting to other sections
(Courtesy of Wikipedia on Waveguides)

Electromagnetic waveguides can be analyzed by solving Maxwell's equations with boundary conditions determined by the properties of the materials and their interfaces. This is pretty complex math (in my opinion) and I won't go in that direction. I will just leave this discussion on waveguides with the simple rule that if the waveguide is too narrow or if the RF wavelength is too long, the electromagnetic fields cannot propagate.

Basic Waveguide Slot Antenna

Slot antennas are a fairly common omnidirectional microwave antenna design. Waveguide slot antennas, usually consist of an array of slots for higher gain that can be used at frequencies from 1.2 to 24 GHz, A typical waveguide slot antenna is seen in **Fig 2**. Note that there are a total of 12 vertical slots machined into **Fig2**; six on the front side and six on the back side. BTW, you are looking through both sides of the waveguide through both sets of the slots.

Figure 2 – 10 GHz Slot Antenna made from WR-90 Waveguide with 12-slot array
(Courtesy of Paul Wade W1GHZ.org)

Paul Wade W1GHZ has a terrific online book called "W1GHZ Microwave Antenna Book" that describes a slot dipole as using a thin slot in an infinite ground plane. The slot dipole is a magnetic-field-dipole and it is the complement to a wire-dipole in free space. That

is: the vertical slot is a magnetic-field dipole and has the radiation pattern as a one-half-wavelength horizontal wire-dipole (electric-field dipole) of the same dimensions. This horizontal polarization of the electric field is due to the fact that in electromagnetic radiation, the magnetic-field and the electric-field are oriented 90 degrees apart (perpendicular). The radiation pattern of a slot antenna is reasonably omnidirectional in the azimuth.

Number of Slots	Gain (max)	Gain (over free-space dipole)	Antenna Length
12 @ 10.3 GHz	13 dBi	~10.9 dBd	~148 mm
24 @ 10.3 GHz	16 dBi	~13.9 dBd	~260 mm
12 @ 1.3 GHz	13 dBi	~10.9 dBd	~1172 mm
24 @ 1.3 GHz	16 dBi	~13.9 dBd	~2060 mm

Table 1 – Comparing gain for different number of slots at 10.3 GHz and 1.3 GHz

The W1GHZ web site (listed at the end of this article) contains spreadsheets and formulas for calculating the dimensions and spacing for locating slots for various waveguide dimensions.

Connecting the COAX

So where and how do you hook up the coax cable to the slot antenna in **Fig 2**? Or if you use some additional waveguide sections as feed-line up the tower or up to the roof...how do you connect the coax to the waveguide?

The solution is to use an adapter to transition from the impedance of the waveguide to the 50 ohm impedance of coax. **Fig 3** shows a diagram of the construction of a Rectangular-Waveguide-to-Coax adapter.

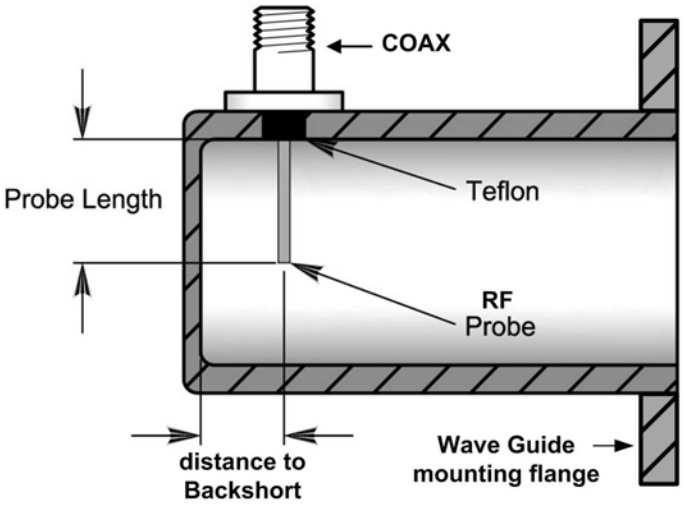


Figure 3 – Diagram of adapter used to allow Coax cable to excite the Waveguide with RF
(Courtesy of W1GHZ and ARRL QEX-2006-Nov)

Waveguide-to-COAX adapters as shown in **Fig 4** are usually fitted with either SMA or N connectors.

Figure 4 – Photograph of typical Waveguide-to-Coax Adaptor for rectangular Waveguide
(Courtesy of Robbie KB6CJZ)

Alford Slot Antenna

Hams also build UHF antennas out of metal cylinders with slots. These slotted cylinders are not waveguides and the antenna is the slot magnetic-dipole radiating omnidirectionally from the cylinder. Paul W1GHZ explains that the Alford slot is an enhanced form of the slotted-cylinder antenna.

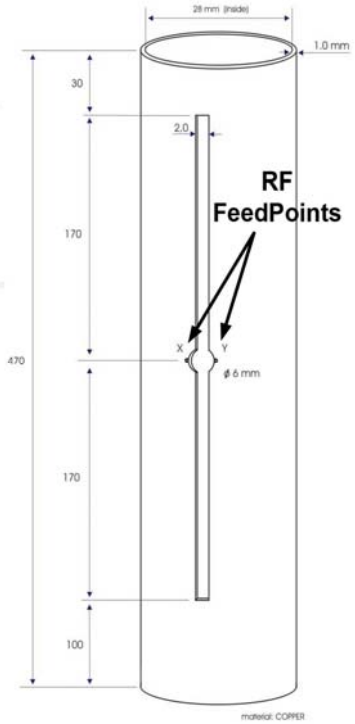


Figure 5 – Diagram of Alford Slot for 23 CMs showing RF Feedpoint in middle of slot
(Courtesy of Mijo S51KQ)

Andrew Alford enhanced the basic slot antenna, designed the Alford loop antenna and designed a number of FM and TV broadcast antennas in the mid-1940's. The Alford half-wave slot has larger dimensions than a halfwavelength wire-dipole in free space and provides gain over a dipole due to the larger aperture. A typical Alford slot has a length around four times as long as a half-wave wire-dipole, producing a gain of around 5 to 9 dBi.

There are two important construction details concerning the Alford Slot antenna. First, the impedance of a single slot is about 200 ohms. So this design requires a 4:1 balun in order to feed from 50 ohm transmitter. Usually the 4:1 balun may be too large to fit inside the cylinder, so it goes at the bottom and feedline snakes up into the cylinder. Second, the feed point for the antenna is in the center of the slot...the feed line comes up through the cylinder and then is soldered to each side of the slot (as pointed out in **Fig 5**). This looks like pretty tricky construction and soldering in my opinion. **Fig 6** shows the "inside job" handywork needed to solder to the slot.

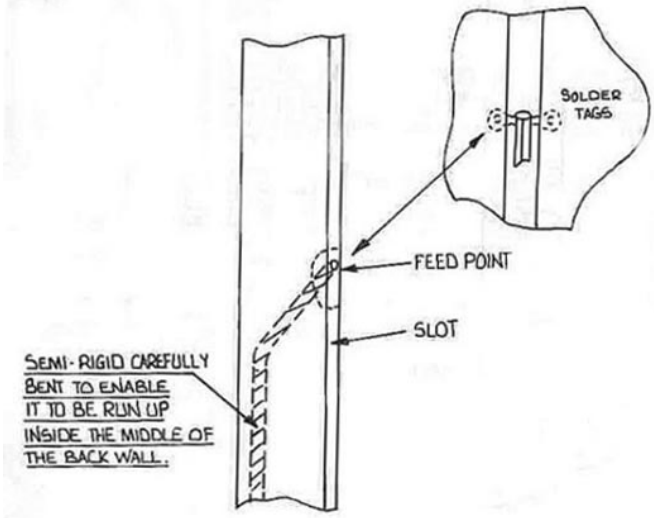


Figure 6 – Bringing the feedline up through the Cylinder of an Alford Slot antenna to solder at the slot.
(Courtesy of Mike G3JVL)

Again the RF electric-field polarization for the magnetic-field-dipole Alford Slot antenna is horizontal.

Weather-Proofing Slot Antennas

You do not want rain or snow entering the slot of either type of the two slot designs that we have discussed so far. So you typically need some type of plastic container or PVC piping to act as a radome for your antenna.

Skeleton-Slot Antenna

When I mentioned slot antennas to a friend of mine, he immediately pulled out his RSGB VHF UHF Manual by G6JP and showed me a skeleton-slot antenna for 440 MHz. G6JP explains "...further experiments showed that a thin rod bent to dimensions of 5λ/8 by 5λ/24 exhibited similar properties of a true [magnetic dipole] slot". See skeleton slot on left side of **Fig 7**.

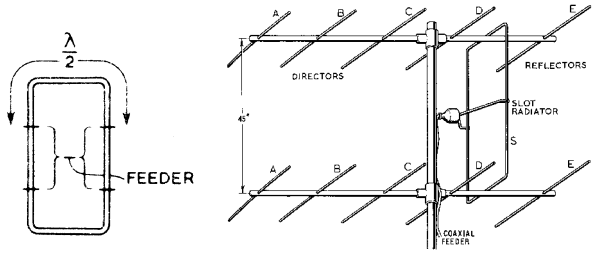


Figure 7 – Skeleton-Slot element can be used as a driven element to feed two stacked Yagi's on right
(Courtesy of RSGB VHF UHF Manual by G6JP)

I don't know…I just don't see the infinite ground plane? It seems to me like this is just a clever way to feed two stacked antennas in-phase, not a magnetic-field dipole?

Conclusions

This has been a fun article to research. I learned a lot about magnetic-dipoles, slot antennas, and microwave waveguides. The Alford Slot antenna does not seem to have a lot of gain…unless all you are looking for is a horizontal-polarized omni. The Waveguide Slot Antenna has better gain than the Alford design…but I feel like you need to have a machine shop to cut slots accurately in waveguide sections or purchase already built antennas from hams who can make them. Maybe one of the readers can explain to me more clearly why a skeleton-slot is really a thin slot in an infinite ground plane?

After this research, I think for now that I will choose a commercially available Comet 1.2 GHz model GP-21 vertical (1⁄2 wave x 21 with 14.9 dBi) for Digital-ATV.

Interesting Links

- British ATV Club – Digital-ATV and DigiLite Forums – see **www.BATC.org.UK/forum/**
- Paul W1GHZ online "Microwave Ant Handbook" – see **www.W1GHZ.org/antbook/contents.htm**
- Dan W6DFW - Waveguide Slot antenna vendor – contact **W6DFW@apex-scientific.com**
- M. Walters G3JVL article on Alford Antennas – see **www.videorepeater.co.uk/help/alford_ae.htm**
- Mijo S51KQ drawings on 23 CM Alford Slot – see **http://lea.hamradio.si/~s51kq/ANTENNA.HTM**
- K5RMG microwave group on building an Alford Slot – see **www.K5RMG.org/Alford-slot.html**
- Comet GP-21 Vertical Antenna for 1.2 GHz (imported to US by NCG) – see **www.cometantenna.com/**
- Orange County ARC newsletter entire series of DATV articles – see **www.W6ZE.org/DATV/**
- Yahoo Group for Digital ATV - see **groups.yahoo.com/group/DigitalATV/**

OCARC
BOARD MEETING MINUTES
2012-05-12

The OCARC Board meeting was held at the JägerHaus Restaurant, 2525 East Ball Road, Anaheim, and called to order by President Paul Gussow W6GMU on Saturday, May 12. A quorum of Board members were present, with only Nicholas AF6CF and John W6JOR not present.

DIRECTOR REPORTS:

• **VP** –Robbie KB6CJZ reported that he is trying to line up four club presentations for this year: Jim Day W6DF on "Radio Ranch", a Web Site Overview, one on Interference, and one on Solar Panels.

- **Treas** – Bob AF6C reported that OCARC had banking accounts totaling $6,579.
- **Sec** – Ken W6HHC reported that the "club e-mail address" for our FD Chair, Dee N8UZE, was now working.
- **Activities** – Doug W6FKX thanked Kenan KR6J and Jeff W6UX for running the monthly raffles while he was gone. The Secretary was asked to send a letter to HRO authorizing Doug and Jeff to be able to pick-up prices for OCARC.
- **Publicity** – Tim N6GP to print out newly updated tri-fold brochures (corrects date for Breakfast) from Bob AF6C...for HRO and for FD.

OLD BIZ:

• **Newsletter Editors**

- June – Nicholas AF6CF
- July – Doug W6FKX
- Aug - ??? [Ken confirmed with Kris KC6TOD that she is too busy with Visalia finances cleanup and as OCCARO Chair to fit into the club editor rotation this year.]
- Sept – Tim N6GP
- Oct - ???

- **Field Day**
  - The next FD Planning meeting planned to be held just before the next club general meeting on May 18.
  - The Board discussed that a Field Day Budget needed to be approved by the membership at the June General Meeting.
  - Paul W6GMU reported that it appears that OCARC may be able to obtain Field Day usage of the Los Alamitos JFT grounds for 2013 (through Cal-EMA and ACS).
- **OC Fair Ham Radio Booth** – Paul W6GMU reported that it was reported at the last OCCARO meeting that there most likely would be **NO** ham radio booth at this years OC Fair....basically no agreement could be reached on a suitable
- **LOTW** – Setting up an OCARC account is in process.

NEW BIZ

(none)

GOOD of the CLUB

Tim N6GP announced that he is planning to work the VHF CONTEST on June 9 (right after the Board meeting). He is planning to visit four gridsquares. He has extended an offer for any OCARC who are interested may ride along. [Details are in this issue of RF newsletters.}

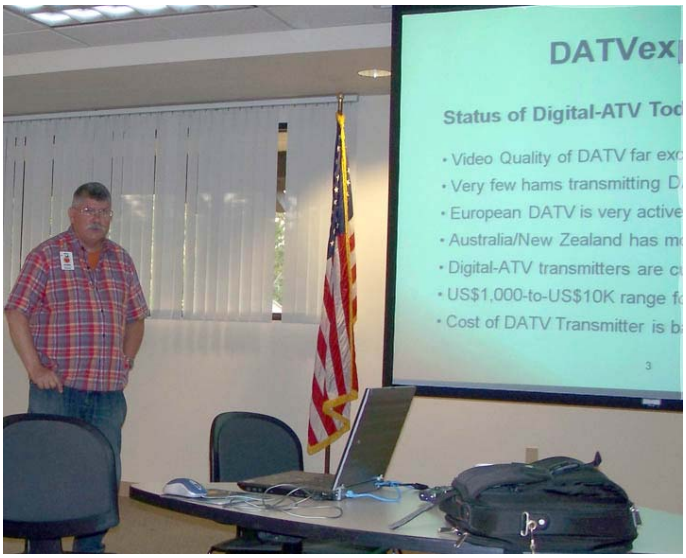
Respectfully submitted by:
Ken Konechy W6HHC, Secretary

OCARC
GENERAL MEETING MINUTES
2012-05-18

The OCARC May General Meeting was held at the Red Cross complex in Santa Ana on Friday evening, May 18th, 2012. There were a total of 35 members and visitors present. Eight club officers were present for a quorum….only Kristin K6PEQ and John W6JOR were absent. The club President Paul W6GMU introduced our speaker, Ken W6HHC, who spoke on:

" The DATVexpress Project… A low cost approach to Digital-ATV"

Ken W6HHC explained that he is part of a small international team of hams that are designing a "lower cost" Digital-ATV transmitter. The team hopes to design a 10 mW "exciter" board for 1.2 GHz that will sale for about one-third of the currently available commercial products that are priced at about $1,000.



Ken W6HHC explained the advantages of DATV over older Analog-ATV technologies

The project team has currently built two prototype DVB-S protocol boards and are now checking out the software for the design.

OLD BUSINESS

• Field Day

– Dee N8UZE reported that a Field Day Planning Meeting had just finished with the various Band Captains present. It looks like OCARC would most likely operate FD as a 4A classification.

- Dee announced that there were sign-up sheets for members to sign up for helping on various bands at FD. Also Dee passed around a sign-up sheet for people to offer to sponsor a specific area of bonus points for the FD contest.

- See more OCARC Field Day details beginning on Page 3 of this issue.

Respectfully submitted by:
Ken Konechy W6HHC, Secretary

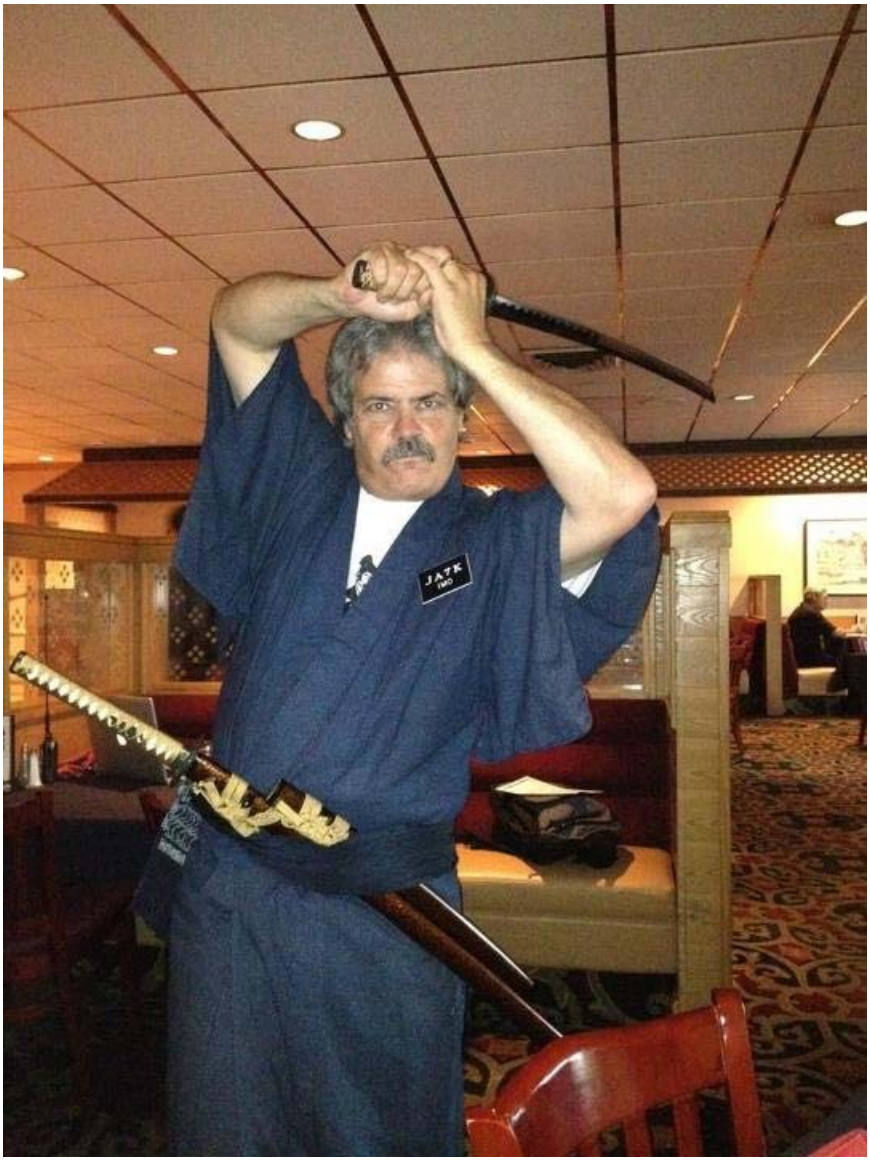
DATVexpress Transmits first Digital-ATV Video Pictures

Ken W6HHC reported that on May 30, the DATVexpress project team had sent their first video transmission using DVB-S protocol on 1.2 GHz.

Charles G4GUO was able to receive a standard definition Digital-ATV signal in his workshop that was being sent using 4 MSymbols/sec with and an error correction setting of FEC = 1/2.

His cat has earned DXCC—on five bands.
Birds stay off his antennas—out of respect.
He doesn't send green-stamps to get a rare QSL—his autograph alone is sufficient.
The FCC issued him his own call area.
He once operated maritime mobile—from a submarine.
Grey-line propagation follows *him*.
He often works EME—Earth-Mars-Earth.
A North Korean wanted to schedule a QSO with him, but the timing wasn't convenient.
If you work him during Field Day, you earn bonus points.
He speaks fluent Navajo in Morse code.

HE IS…



THE MOST INTERESTING DX'er IN THE WORLD!

"I don't always chase DX, but when I do, I prefer six meters. Stay radioactive, my friends!"