PRINTED CIRCUIT

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FED GRANTS Not For Profit Status to JARC

In a letter dated July, 28, 1999 the JARC was notified that the INTERNAL REVENUE SERVICE had granted the club recognition as a 501-C4 Exempt Organization. This classification describes Not For Profit Corporations created for the community/public welfare.

From telephone conversations with Jim Brophy, the case worker for the IRS, Jim Johannes was encouraged to modify the current application from 501-C3 to this classification. Mr. Brophy indicated that it more reflected the purpose set out by the club in the original application (see below).

Item 2: The mission of the Club is to provide;
(1) Emergency local radio communications in the event of a disaster for the Red Cross and Salvation Army.
(2) Provide and activate the local Skywarn weather net injunction with the Jasper and Newton County Emergency Preparedness Coordinators.
(3) Provide and maintain a Local VHF repeater to communicate during operation and the above functions.
(4) Conduct monthly local meetings to provide informative and educational information.
(5) Annually conduct local educational classes to provide instruction and testing prospective new amateur radio operators.
(6) Conduct monthly ARRL sanctioned operator exam testing.

After the recommended changes were made to the application and it submitted, the response was very rapid.

New avenues have opened for the club with federal recognition as a Not For Profit Corporation, to start, Jim has applied for state for sales tax exemption.

The MS-150 Rides Again

If you listened to the repeater this past weekend, you would have heard quite a bit of activity with the annual running of the MS-150 bicycle ride. This year's route started at the high school in Republic, Missouri, passed

through Carthage, and ended in Joplin for the overnite stay. The first day's ride was a rollercoaster of approximately 87 miles, with a century loop option totalling 100 miles.

The 2nd day started from Joplin and ran (in a roundabout fashion) to Pittsburg, Kansas, a distance of 68 miles. Several club volunteers could be heard on the air both days working the event.

The ham community benefits with great P.R. provided by events like this. If you want to help on future events contact Andy KA0TUD for additional information. ¶

JARC INTERIM OFFICERS ELECTED

The surprise resignation of both the secretary, and vice president necessitated a special election for their replacements.

In accordance with the JARC Bylaws, at the regular meeting on August 24th, president Ray Brown KBØSTN declared it an emergency meeting and called for nominations to fill the vacancies for both positions. The election proceeded once candidates were found, only after having several nominations made, which were graciously refused.

In the wake of all this, two nominations succeeded. Dave Ferguson NØKMP and Jim Scott WBØIYC were voted upon for Vice President. Without any takers for club secretary, that post was left unfilled with the responsibility passed on to the treasurer till a volunteer would take it.

Jim Scott was elected to finish the term of club Vice President. Subsequently, Dave Ferguson offered to complete the term as the club Secretary.

Other business brought before the club this evening was presented by Jim Scott, the chair of the Technical Committee. In a brief presentation, a plan was offered with a request for funds for the replacement of all feedline at the 147.21 MHz repeater site. The costs associated with the replacement of the cable was estimated not to exceed $3800. A motion was offered by Les AAØGY to do it, which passed unanimously after members discussed many aspects of the issue.

inside...

BACK IN THE DAYS OF "RADIO"

BY FRANK GREENHALGH

My grandson is four years old and I know he has the right stuff to be an engineer. He is curious, imaginative and learns fast. He is a whiz on the computer, a master of the mouse -- building virtual castles on a 21" monitor. How different his introduction to the world of electronics will be than the one I had. He is already living in the time of cell phones, satellites and computers. Looking back on my own life I have come to realize how fortunate I was to have grown up back in the days of Radio.

Actually, radio or wireless communications started way before I was born. At the turn of the century the ships at sea would fire up their spark coils and key them into an antenna. Basically it was a high power pulse generator with high harmonic content. The resonant frequency and Q of the antenna system determined the frequency of transmission. Reception was on a crystal set. Still, we see that this crude system was of value in the rescue of the Titanic. If the captain had more faith in radio, he might have even heeded the iceberg warnings his radio operator was posting on the bridge. When the movie "Titanic" shows the radio room, you hear the operators listening to a pure tone creating the dots and dashes. Not true. Those spark transmitters sounded more like a cold war jamming signal, or a chain saw being turned on and off than a flute playing one note.

The spark gap age ended when vacuum tubes were invented. Transmitters were able to produce a pure sinusoidal oscillation, which was easier on the ear, more efficient and of a single frequency. By the late 1920's, engineers had learned to modulate the amplitude of the waveform allowing the transmission of voice and music without wires. Thus entered the golden age of radio. Early radio was a wonderful invention. During the next two decades it provided the common people with real time entertainment that previously had been only available to the rich. Radio had entertainment with live orchestras, baseball, boxing, election and war news in real time.

I was born in 1937. In the early 40's, my dad helped me build my first crystal set. It utilized true breadboard construction. Built on a piece of 6" pine plank, it had a "tank" circuit formed by a variable capacitor which consisted of two series of interleaved semicircular aluminum plates about 3" in diameter. The dozen or so plates were separated by about a sixteenth-of-an-inch of air. The amount of interleaving could be varied by rotating one series of plates into the other; this varied the capacitance between the plates. The "tuning" capacitor was connected in parallel with an air coil (inductor) we made by wrapping about 100 turns of wire around a 4" diameter cardboard Quaker Oats container. The tank circuit was connected between the antenna (a wire strung around the room) and ground (a radiator.) It probably was not much different than the one on the Titanic. A piece of germanium crystal about 3/8"diameter had one side attached to the antenna. A "cat's whisker" contacted the open face of the crystal. The cat's whisker was a piece of coiled spring wire mounted on a base swivel. One side had a small Bakelite handle. On the other side, the spring wire protruded at a 90-degree angle to the spring. The base of the spring was attached to a set of headphones whose other end connected to the ground side of the tank circuit. The first thing you did was establish a good semiconductor connection to the crystal. You would put on the headphones and point the spring end of the cat's whisker into the crystal. When a correct connection was made, the headphones would erupt in sound. By tuning the capacitor, you could then hear different local radio stations. No batteries required. The sound was like magic. I was dumbfounded. Here was enough power to put audio into my headphones just by connecting this circuit between an antenna and ground.

Just think of the lesson these components taught us. I could almost visualize the waves floating on that coil; learning to change the frequency by watching a capacitor increase in area across the air dielectric; adding or reducing turns of the coil changing the tuning range. Even the earphone pieces could be unscrewed, and you could observe the way the coil wrapped around the magnetic structure would move the diaphragm, producing the sounds.

Next came the one tube set. We built that using a triode vacuum tube. Now I could watch as the filament would glow red and actually see the path the electrons would take, imagining that I saw them flow past the grid and onto the plate. They must have been, because the radio worked great even though I had to keep changing batteries.

My love for radio never slackened. When I started high school, I continued to build electrical projects such as a code practice oscillator in preparation for an amateur radio license, a VTVM (vacuum tube volt meter) and a GDO (grid dip oscillator.) By the time I was 15, I had the license and built my first transmitter from a kit by the Heath Company. I can still remember . . . it used a 6SJ7 oscillator driving a 6L6 amplifier. Soon I was contacting other amateurs by Morse code. Not much -- unlike the operator on the Titanic fifty years before. By the time I graduated high school, I had transmitters operating on all the low frequency bands with up to 500 W of power. The output tube, an 813, was a huge bottle. It had a plate cap and a large visible plate that would glow red if you tried to operate it out of resonance. The modulator tubes were 811s. They would emit blue light when you spoke into the microphone, indicating that the audio was modulating the carrier. The 866 rectifier tubes used mercury vapor and glowed bright blue -- with increased current through them. I loved to operate at night with the lights low so that you could see the electronics in operation.

At college, they had a different perspective. Two years of math and

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physics before they even taught anything about Ohm's law and mesh circuits. It was boring. In the 1950's, the state of teaching electronics was very crude. Most colleges taught mainly power engineering, assuming you would work in generating plants or design motors for trains and the like. Some courses would teach you how to design using vacuum tubes if you were determined to learn about electronics. The oscilloscope was not used; actually oscilloscopes with calibrated time bases and triggered sweep were not even available. Students were taught how to "guess" what the waveform of a pulsed circuit would look like by using such gauges as the Q and resonant frequency of the circuit. Yet from these humble beginnings engineers had designed not only radio, but also television, radar and computers.

A stint in the Navy Air reserve in the late 50's taught me to how aircraft electronics and electrical systems functioned. Voltage regulators for the plane's 28-V system used a "carbon pile regulator" which was a bunch of carbon granules packed in a tube and connected in series with the field coil of the plane's generator. The resistance of the pile would change depending upon the pressure on it. A spring and solenoid controlled the pressure. Lower voltage out, more pressure on the pile, lowering its resistance, producing higher current to the generator field thus increasing the output voltage. Wow it was so simple to understand feedback this way.

The VHF transmitter (ART13) used the same 813 tube my ham rig did. The most technologically advanced design we had was a UHF tube transmitter (ARC27) which had about two hundred channels all tuned by servo motors. The auto-pilot was controlled by on-board gyroscopes. Three gyroscopes were used to measure the yaw, pitch and roll of the plane. Once caged and released they would maintain their position. If the plane changed its pitch, the pitch gyro would activate a switch that would change the controls to correct it. When the plane was stable and on course, the pilots would "cage their gyros." During flight the gyros would drift and have to be re-caged.

In 1960 I started working in the military electronics industry. Fueled by Vietnam and the cold war, this industry was really hot. On the hobby side, amateur radio was also hot. A new mode of transmission called SSB (single-sideband suppressed carrier) promised to replace the old standby AM (amplitude modulation) which had been around since the twenties. Of course this did not come without some problems. SSB required stability of transmission and reception, the lack of which caused voices to sound like Disney characters. No commercial transmitters were available so we had to build our own. SSB evolved from the amateurs of the 60's and their toil. Today SSB dominates both military and amateur communication modes.

The transistor was now available in reasonable quantities. Small signal npn devices could be made of silicon but with a very poor yield. They cost $35 each and about double that for pnp. Equivalent germanium devices cost only about $5. A problem with germanium transistors was that they would leak current from collector to base causing runaway at high temperatures as the leakage increased. They were not used often in military designs.

Instruments were crude. Oscilloscopes had maximum sweep speeds (and rise times) of 1 ms/cm. Audio generators used a Wein bridge oscillator, which had a light bulb that was used as a negative resistor for the oscillator. Counters were large desktop devices with plug in modular construction using four tubes per module per decade. Their readout was from incandescent light bulbs behind numbers from zero to nine. You would count frequency in counts per second, or ten seconds, and watch the lights flash until they stopped showing the number counted.

These were wonderful days for engineers. Everything was new. No one had been taught about transistors so we would learn by breadboard and try. A "beta checker" was a must in every lab. You would insert the transistor into the device and press a button. A meter would go upscale and measure the "beta" or gain of the device. It was highly inaccurate because it measured dc beta and included leakage current. Still we used it to see if we had blown the transistor.

The field I worked in was power supply design. In 1960 there were no commercial switching power supplies. Working for the military allowed spending the ludicrous amounts of money for components required for switching power supply designs. Aircraft needed lighter power supplies and the fact that you spent four hundred dollars on a few switching transistors for a 100-W power supply didn't matter. The size and weight did. The first designs were limited due to transistor availability. Even the fastest devices were very slow and the diode specifications did not include recovery time. We had to test each manufacturer's diodes to determine if they could be used. Our home-built test set used a mercury relay to switch the diode current on and off. It was the only thing available that could switch a current fast without contact bounce.

Teflon-coated wire was considered exotic and very expensive. Yet it was required for the military temperature range. We learned that when our first prototype failed at 95 deg C. The PVC wire we had used in the harnesses had melted and shorted out. Differential voltmeters were null type. You put the probe on the voltage to be measured and spin about four knobs until the meter was at zero (nulled) the voltage could be read by the numbers the knobs pointed to. The highest practical frequency of operation was 10 kHz, and no matter how well the magnetics were encapsulated you could hear the power supply switching. By the end of the 60's, frequencies were up to 20 kHz and the $50 transistors were now about $3. We developed the first 100-W commercial switching supply in the country using our military designs with the now inexpensive transistors. Meanwhile the space program put a man on the moon using this equipment.

The 70's introduced us to the integrated circuit. Operational amplifiers, flip-flops and the 555 timer were big hits. In the past you had to do complete discrete design, now you could add a few components to an IC and you had an amplifier or oscillator. By the end of the seventies, chips that

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could operate all the functions of the pulse-width modulated power supply could be purchased. Diodes had improved, frequencies moved to 50 kHz and commercial switching power was now a success.

When the 80's came, so did the personal computer. Over the next decade the PC and workstation did more to further engineering than anything else. By the end of the eighties printed wiring boards were laid out on PCs. Gain/phase predictions were also done on computers. Engineers now could design with high accuracy, using circuit simulation on a PC. The breadboard became a thing of the past. Through simulation, you could design extremely complex circuits . . . So complex that breadboarding them would be impossible. Chip makers designed chips to perform all the power functions. Engineers spent more time studying app notes than they did troubleshooting breadboards or brass-boards as they now became known.'

Thus ended the days of radio. Electrical design was now in the hands of the chip makers. No more seeing the electrons, even the transistors. Now all you could see was the multi-layered printed wiring board with these chips on them. Engineers had to learn to think virtually. And they did. As we head into the last year of this century we are masters of our technical domain. Astonishing strides have occurred in the 1990's. We have produced satellite communications, the Internet, audio and video compression, power circuits switching in the megahertz region, cell phones, CD-ROMs, DVDs, digital cameras. It all came in the last years of this century. Not too fast for an old engineer like myself to keep up with, but I am lucky to have been there when it all started.

My grandson will never know the luxury of watching a technology grow. He will have to catch up to where we are now before he can add to the earth's knowledge. I know he will, but I am glad that I had the slow progression. Back in the days of radio.

About the Author

Frank Greenhalgh has been working in power supplies and systems for 38 years. He has many impressive accomplishments and patents. Over the years he has made significant contributions to Trio Laboratories where he held the position of Chief Design Engineer and was then promoted to Vice President.

He co-founded CEAG Electric Corporation (now ABB CEAG) and developed the first mainframe power system using the droop paralleling concept. He has written numerous articles and columns, presented papers at the milestone PowerCon convention and consulted for ABB CEAG and other companies. Recently his accomplishments include the development of two Web sites, www.fgl.com with the Power Corner and www.amityville.com. Frank is presently functioning as "Director of Technical Sales" for Toritsu Tsushin Kogoyo Corp.

UPCOMING CLUB EVENTS

FOX HUNT RESCHEDULED FOR SEPTEMBER

The JARC is sponsoring a FOX Hunt on Saturday, September 18. This event will be setup for teams of two persons per vehicle. Each team should have at least one 2m radio and some form of directional antenna. The hunt will last for about one to 2 hours. Refreshments will be served at the end of the hunt. The event begins at 10 a.m. at Ewert Park in Joplin. The park is located north of the intersection of 7th Street and Murphy Blvd. We will begin in the parking lot near the tennis courts.

OCTOBER TAIL-GATER PARTY IS BACK

The J.A.R.C. is scheduling its annual Tail-gater Party on Saturday, October 2, at Ewert Park, from 8 am to 12 Noon. Donuts, sodas and coffee will be provided by the club. Bring your stuff, sell it, buy some stuff from someone else, and make everyone happy. ¶

HAMFEST CALENDAR

Note: Listings are updated as information becomes available. Courtesy of Lonnie Allen NØTBO

September 18 Little Rock, AR
CAREN, Little Rock, AR Scott Derden, K5SCD
12 Sallisaw Circle, North Little Rock, AR
501-834-1881
E-mail: sderden@flash.net
Web-site http://carenclub.webjump.com
***

September 24-25 St. Louis, MO
1999 QCWA National Convention
Missouri Chapter 19 will "SHOW YOU ST. LOUIS"
Some of the FORUMS included this year:
WCWA President Gary Harrison, K0BC
ARRL 1st VP Steve Mendelsohn, W2ML
Amateur Satellite Communications, Former AMSAT Dir., Roy Welch W0SL
Intereference Detection, Direction Finding, Transmitter Hunting, Mike Musick, N0QBF
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October 1-2, 1999 Springdale, AR
NWAARC Hamfest for 99.
Jones Center for Families in Springdale
Friday from 7pm-10pm setup at 5pm.
Saturday from 8am-1pm setup at 6am.
Programs and VE testing. Pre register with Mac W4FH at 501-443-3359
E-mail: dmacdona@ipa.net
Tables are $6.00 Tailgates $4.00
Admission $5.00 call 501-631-9231
E-mail: kc5uew@mc2k.com
***

October 2nd Warrensburg, MO
Hamfest '99 presented by
Warrensburg Area ARC, Inc.
No Admission Charge
American Leigon--Business Route 50 East--Warrensburg Mo.
Talk -in 146.28/88 - Doors open at 8:00 AM--- Hourly Prize Drawings----Grand Prize Drawing----Exhibitor flea market tables $12.00-----Prize Drawing Tickets $3.00 each or 2 for $5.00
Contact Keith Haye WE0G
816-679-3426
Email: we0g@microlink.net
or write to: Warrensburg Area Amateur Radio Club, Inc.
Attention Hamfest Committee,
P.O. Box 1364, Warrensburg, Mo. 64093

CALENDAR ON THIS PAGE

ALSO UNUSED JUNK TO SAVE FOR FUTURE ISSUES

Meeting Times, Testing, and other Club Information

The **Joplin Amateur Radio Club, Inc.,** a Missouri *not-for-profit* organization, meets on the second and fourth Tuesdays of each month at the Joplin Municipal Building, on the lower level, in the Civil Defense dining room at 7:30 PM. The facility is accessible to the handicapped.

The club supports and promotes annual operating events, assists area agencies with communications when requested, and offers training classes for advancement in amateur radio. It also sponsors the JARC HamFest each year in April, and maintains a wide area coverage OPEN 2m repeater on 147.21 MHz.

Club members often meet weekday mornings in Joplin for coffee at the Target Store (3151 East 7th St.) around 8:30 a.m. Members also meet for breakfast on Saturday morning around 8:30 AM. Presently, the club is searching for a new location for the weekend breakfast. Contact Betty Miller for details at (417) 624-4903.

1999 CLUB OFFICERS:

President:	Ray Brown	KBØSTN
Vice-Pres.	Jim Scott	WB0IYC
Treasurer:	Jim Johannes	NØZSQ
Secretary:	Dave Ferguson	N0KMP

Amateur Radio VE Testing

License testing by volunteer examiners takes place on the 3rd Thursday of each month (except June & July) at St. Paul's Methodist Church located at 2423 West 26th St. in Joplin. Sign up at 6:30 PM, testing begins promptly at 7 PM.

ABOUT THE NEWSLETTER

This club newsletter offers an open forum for the Four-State area amateur radio community, and ***your*** comments and contributions are always invited. Items for publication, including classified ads and amateur radio related articles, may be sent to the **JARC Printed Circuit**, P.O. Box 2983, Joplin, MO 64803-2983, or send email to: **jim-scott@janics.com**

Deadline for submissions is the 20th of the month preceding the month of publication. Non-Commercial Classified ads are free and will be run on a space available basis whenever requested. Submissions may be typed, handwritten, ASCII text files attached with email, or on disks formatted for IBM. *All items* are subject to editing for spelling, content, and space limitations as required.

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