Mike, NI2S's Ham Blog

Welcome to my blog. On this page I will chronicle my Ham Radio adventures, such as they are. Currently, the primary purpose of this page is to share my efforts to build a fully loaded Elecraft K2 QRP rig.

Bio/background: First a word or two about the operator.....I was introduced to Ham Radio by my father, K2AJV(SK) at an early age. In fact, I attended my first Field Day at the age of 7, and it was that event which hooked me on Ham Radio. I obtained my novice license at the age of 16 in 1977. By 1979 I had my General. There I remain, though I aspire someday soon to get my Extra. Even before I got my ticket, I had built (though very poorly) a Heathkit HW-7 and an HW-8. Kit building was in my blood. After a number of years, and with improved patience and skill, I built a Heathkit HW-5400, which replaced a Ten-Tec Century 21 as my primary HF rig. I never did have much luck with QTH's being favorable to the hobby. I bounced from one RF hole to another. Even my present QTH in Boonton, NJ is not ideal. I was on the air over the years sporadically, frequently frustrated by a general lack of ability to get my signal out beyond the borders of the State. In time, I was able to afford a top flight rig. The Yaesu FT-1000MP had been recently introduced, and I had to have it. So, the HW-5400, which was getting a little PLL shaky anyway, was retired (I will never sell it). Then I bought my house here in Boonton, and the Yaesu stayed in the box while I launched a highly ambitious top-to-bottom overhaul of this old house. For the next 10 years, my only HF operating was at Field Day (usually using said FT-1000MP), and VHF/UHF.

Along the way, when I naively thought I was nearing completion on the house, I decided (with some goading from Brian, KF2HC) to buy an Elecraft K2 as my reward for being H/F deprived all these years. So I purchased K2 SN#353. I promised myself that I would not build the K2 until the house was finished. Well, after 4 more years, the house is finished. Time for a different kind of construction project!

The Elecraft K2

(100 Watt version pictured)

1/Jul/06: The first order of business was to allocate a corner of my basement to my ham shack. So, after a marathon of cleaning and chucking the various accumulated flotsam from my remodeling efforts, the basement was cleared. I purchased an L shaped desk for $127.00 from Staples, and began accumulating my ham gear scattered though-out the house and garage. Concurrent with cleaning chores, I contacted Elecraft and asked them for advice on kicking off the kit build after sitting on the shelf for so long. I assumed - correctly so - that there were many enhancements/revisions since I bought #353. Elecraft provided the necessary sage advice, and I wound up ordering a supplemental enhancement pack from them for $159.00 to bring my Revision A rig up to a Revision B build. Technically this means my rig is no longer SN#353, since Elecraft ups the SN when you do this. But to me, the rig will always be good ole #353.

I dug out my anti-static mat, dusted and cleaned my articulating magnifier lamp, and set up the other necessities of a major kit build and...now I am ready!

Build components:

	K2 QRP HF Transceiver	SSB Module
	160 Meter Module	Audio Filter module
	Battery Supply Module	Automatic Antenna Tuner
	2nd Ant. Mod	Noise Blanker

Here is a pic of my shack's kit build work area before starting: 

Control Board Assembly

27/Jul/06: The first component to be assembled is the control board:

 __And so it begins!! The first part is laid, a 33k ohm resistor:

 __And after completing the 1st page of installation instructions:

From here on out, I will be posting discussions of the various elements of assembly that I find the most challenging, along with pics. I will also post when I complete a PCB. Now that I have started the build, I can say that the use of a lighted, articulated magnifier is a must (5x is best I think). Also, keep in mind that I have one rather significant handicap in

building this rig: I am color blind in red and green. This means I am almost solely dependent on my VOM (Volt Ohm Meter for the un-initiated) to determine the resistance of banded resistors. What I do is study the resistor bands, and take a guess at what I think is the correct resistor. Then I hook it up to the VOM to see if I guessed right. Most times I do guess correctly, but about 20% of the time I guess wrong, and the VOM tells me so. I particularly struggle when red and brown are next to each other, and green and orange side by side throws me too. Subtle differences in shading are the tip off on which color it might be. So, I proceed very slowly and carefully when installing banded resistors because of this. Everything is checked and measured at least twice. If I've screwed up the setting on my VOM, then that could mean the difference between installing a 100 Ohm resistor and a 100K Ohm resistor. Caution rules the day! Especially so because it's been a very long while since I've built a complex kit. And an equally long while since I've had to use my VOM to identify resistance measurements. Time will tell if I got it right or not. I will have the same difficulty if color wiring comes up down the road in this build. The Heathkit HW-5400 was **loaded** with colored wiring, and it drove me nuts! Wish me luck!

3/AUG/06: The Control Board assembly is now complete. I had no major problems assembling this board. The iterative assembly steps were clear and concise - easy to follow along. None of the component installations on this board had a high level of difficulty, although you do need some skill with a soldering iron, which is quite easy to obtain with modest practice. I had a little trouble with the crystal grounding jumpers, and a little trouble positioning the '103' cap on the back (solder side) of the board.

A few *minor* gripes of the Control PCB assembly process (strictly my opinion, of course. During the build, I was instructed to use several of the cut leads from the components I had previously installed. However, since I was trying to keep my work area neat and clean, I was throwing those leads away as I cut them off after soldering. At the beginning of the assembly instructions, there should be a note that several of the excess leads will be needed as jumpers. Digging through the garbage bag was not fun.

On Page 15 of the assembly manual, the instructions indicate to install "all" the capacitors except for the cylindrical electrolytic types. Well, at the end of installing "all" the capacitors, I was left staring at C44, smack in the center of the board, wondering where I skipped over it. At the

very end of the Control board chapter, it states that C44 is not used. Better to put that comment in the section where it says to install "all" the capacitors.

Also on Page 15, the manual says to install all the above capacitors dry, and then solder after all are in place on the board. I don't agree with this. The spacing of these components makes it difficult to maneuver the solder iron around to solder them all in one shot. And it is too annoying to stop and snip leads after each solder. So, since the installation of these caps generally proceeds left-to-right (from the component side perspective), my recommendation is to break this up into thirds and stop, solder a group, install the next third, solder them and then the last third. This applies to group resistor installation as well - too many leads jutting out all over the place makes positioning for a good solder annoying.

As with the Heathkit manuals of old, it would be great if a to-scale ruler were printed along the bottom of the page where measurements are called for.

I am of the opinion that C6 should be installed after the X1 crystal grounding step on Page 16. This would make positioning the ground jumper a little easier.

Here are pics of the finished Control board:  

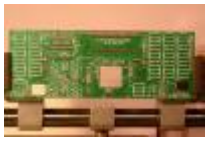
Front Panel PCB

4/Aug/06: Next up for assembly is the front panel. On the front panel, I had no difficulties at all. I followed my own advice and broke up the capacitor install to solder fewer at a time. I found it easier. I did study the cap install to make sure I would not do harm by soldering early, and no harm was done. There are many precision steps on this PCB, and I had no trouble executing these steps. One piece of advice - READ the entire step before jumping in to a particular task, AND read the next step to be sure there are no land mines ahead. The instructions for this board were top notch.

Having learned my lesson on the Control board, this time I set aside my component lead cuttings and sure enough, two jumpers were needed on this board. All was well, no digging through nasty garbage bags for cut leads this time. I still say the need for some of these cut leads should be noted in the beginning of the build chapter.

I did have one minor scare - I brushed one of the push buttons (S11 to be exact) with my soldering iron and melted the tip, where the rectangular button covers snap on. With some careful trimming/re-shaping using a sharp Exacto knife, I managed to salvage the switch. The button cover snapped on and stayed on and the button functions normally.

The Fronel panel board is now complete up to the SSB add-on. Since I bought the SSB add-on, that's next. Here are some pics of the Front Panel build thus far:

Raw PCB at the start - no parts installed yet: 

Here is a pic installing the switches and using the Elecraft provided spacing tool:

 Here is a pic of the component side of the PCB, waiting for the SSB parts:  _Here is a pic of the solder side of the PCB, waiting for the SSB parts: 

As you can see in two of the above pics, there are 3 (#4) lock washers protruding beyond the border of the PCB. Time will tell if this will cause an assembly problem. I do have a complete Dremel set, and plan to grind the protrusions off if I must. For now, wait and see.

05/Aug/06: Near the end of the Front Panel PCB build, the instructions state to assemble the SSB module, and install the parts on the Front PCB that support the SSB add-on (included in the SSB module parts bag). The SSB Module is particularly challenging because the spacing of components is extremely close, as the manual aptly warns. Here, I don't think I will be able to get away with doing only a relative few components before soldering.

Here is a Pic of the unassembled SSB PCB:  - now that's one crowded board!

Here I had my 2nd solder iron goof. While soldering in the mic 10 pin connecter, (this component is installed on the back of the Front Panel PCB, and soldered on the component side, a millimeter away the S4 & S6 switch bodies) I brushed a switch cover with my iron, partially melting it. No way to salvage this mistake. I will have to get a replacement cover from Elecraft. 

I think this should be part of the mic connector install procedure: When soldering the 10 pin connector, REMOVE the button covers from S2, S4 and S6. Re-install covers after this step (note that my add-on module manuals are all about 4 years old, so it is possible that some of my comments may have been addressed by Elecraft since then. I am using an up-to-date version of the Transceiver manual, which I purchased along with the Rev B upgrade pack - only the add-ons are old docs.)

Having installed most of the capacitors on the SSB board, I adopted a different solder strategy. I am installing all the parts 'dry' as per instructions, and then I solder from the outside edges of the PCB and work my way in, usually soldering 3 - 4 components at a time, snipping leads, and continuing on. Works just fine.

This is definitely a challenging module, requiring solder skill, needle-nose pliers skill, and patience. I found that many of the small sized capacitors (2.5mm lead spacing) did not sit flush against the PCB. There are several warnings in the SSB manual regarding the dangers of not seating the caps flush against the PCB. Using a small pair of needle nose pliers, I had to straighten the cap leads at the body of the cap into order to get them flush against the PCB. This is rather

perilous work, as you can easily wreck a capacitor and not know it. Some caps I could tug through the PCB holes, but many needed to be worked with the pliers. Time will tell if I got it right or not. Even though the SSB PCB is much smaller than the Control and Front Panel PCB's, I am spending more time on the SSB board than either of the two others. Patience, patience.

07/Aug/06: I ran into a snag tonight which required me to stop and email Elecraft for guidance. The basic issue is a vague discussion of installing R14/R15, on the SSB PCB, and whether they are installed on the solder side, or the component side. In the spirit of "never assume", I must ask for clarification here. I am also a little concerned about the fact that all of my add-on modules are Rev A, and I am going to be installing them into my newly minted Rev B. I am looking for assurance from Elecraft that this will work, and that there are no other Rev parts needed for the various optional modules I purchased along with the Transceiver way back when (as noted in my Kit Inventory above).

I did make progress today, I just had to stop before I got too far ahead of the step in question, and perhaps caused problems for myself down the road. Thus far, the Kit Build Fun-o-meter is pinned. I am having a blast.

09/Aug/06: Elecraft has spoken - the mystery of the R14/R15 position has been solved (resistors installed on solder side of the PCB). Got an email from Elecraft yesterday on this, and I installed the resistors as instructed. I continued on tonight, installing electrolytic caps, more resistors (of which one is AWOL) and a handful of DIP IC's. I stopped at the crystal filter install on the SSB board. For my three inquiries with Elecraft thus far, they have been both responsive, and quite helpful. They get high marks so far for customer support.

Here is a pic of the board before the crystal filter install: 

10-Aug-2006: The SSB board is complete.   There are 4 toroids to wind on this board - the first to be wound for this kit. Winding toroids is

everything it's cracked up to be - tedious. I counted the winds on each toroid 4 times, so they'd better be right. The wires for the toroids were red and green colored, which made me groan, being color blind in both colors, as I mentioned above. I took a guess, and went with it. I think I guessed right. I found the solder blob technique of removing the enamel insulation for the end leads easy. It just requires patience - I went over and over the leads with the solder iron, building a solder blob up on the tip of the iron, then slowly running the solder blob down the lead to burn off the enamel. All the toroids soldered into the PCB just fine, so I am confident the enamel removal was a success. As a result of my email to Elecraft, they told me to install RFC1 and RFC2 on the component side of the board instead of the solder side. If I had not had a doubt about R14/R15, and emailed Elecraft, I would have missed that change because the manual that I had said to install on the solder side (and the Errata sheet did not mention this change). Moral of the story: if you are not sure about something - don't hesitate to email Elecraft Support and ask. You'll be glad you did!

There are a few parts to install on the RF board in support of the SSB module. I decided not to install these just yet. I packaged the RF board SSB parts, and included them in the RF Board parts bag along with the manual for the SSB module. The SSB manual is written with the assumption that the SSB board is being retro-fitted into a built kit. Since mine is un-built, I will incorporate the RF board changes as I come to them in that PCB build. Now, back to finish the Front Panel.

Problems, problems, problems.

My return to finish the Front Panel board assembly was foiled by a bad part. This is not Elecraft's fault. There is a piece of transparent green film that is supposed to be glued in place over the bar S Meter opening on the Front Panel. Elecraft supplies two small strips of two sided tape. Unfortunately, that tape has been sitting around decaying for about 4 years, so it is no longer 2 sided tape. The glue separated from the tape, and that is the end of that. I have to order the replacement switch cover anyway, so I will order this up too. It does mean probably a two week delay in finishing the Front Panel assembly.

But wait - there's more bad news.

In my enthusiasm for the build, I intentionally skipped over some resistance tests that Elecraft specifies for the Front Panel and Control

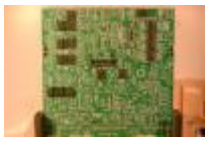
boards. Well I decided it was high time to go back and take those resistance measurements, and see where I stood. How the *mighty* fall: About 30% of the total resistance tests across both boards failed to meet the specification (Yikes!). Several of the resistance tests indicate an open somewhere. I have done some circuit tracing but so far I haven't turned up any component install mistakes. Due to my color blindness problem, I may have to bribe someone for a 2nd pair of unimpaired eyes to make sure I've got my resistors correct. It's also possible that I may have fried an IC or transistor with too much heat during soldering. The sleuthing begins. I will exhaust all my troubleshooting options before I throw in the towel and seek out Elecraft support. While this is both a set back, and certainly a disappointment, my enthusiasm for this kit build is un-diminished!

While I wait for the needed parts to finish the Front Panel.....I will split my time between the RF (Mother) Board assembly, and the troubleshooting of the Control and Front Panel boards.

Here is a pic of the RF Board before component install begins:  I don't call it the Mother board because I am attached to it in an odd-ball sort of way, it's the main (and largest) board in the kit. Can you tell?

21-Aug-2006: Having revisited the resistance measurements for the front panel board, I find that I am slightly off on one measurement and I suspect the others are fine. Just to be safe, I will email tech support and ask, however, I am feeling confident enough to continue with the Front Panel Assembly. Elecraft shipped out the new double sided tape and button caps, so I continued. Here is a pic of the finished Front Panel Assembly  . So cool.

The control board is another issue - there are measurements on that board that are not adding up. Troubleshooting continues. Meanwhile, I pace myself between tasks. Here is the latest motherboard pic with all the 5v relays installed as well as the U1 IC socket:

 . The 5v relays are all installed in one shot. You position all the relays on the PCB, put a flat board on top of them and then flip it over. I soldered only two end pins per relay at first to make sure they were all truly flat against the PCB - most were not completely flat, so I went over each relay and flattened all the them to the PCB by reheating the two soldered leads for each relay.

25-AUG-2006: I worked through to the first series of resistance tests. Here I had no issues with these tests. Here is a pic of the RF PCB at the first resistance tests stage:  Continuing on to install a number of additional components, I have a few minor critiques of the manual: The description of components that are not marked, or minimally marked is inconsistent. Where-ever Elecraft describes a component, the description is dead-on, and very helpful. However, there are not enough of these descriptions in the install steps. At the point where a number of jacks were to be installed, you are forced to fish through the back of the manual to see an illustration of the part in the Parts Inventory Appendix. It just seems to me that, with modern desktop publishing tools, it would be easy to put the pic of these unmarked parts right there at the install step where they would be most handy. Stopping to page through the manual one step after another after another is rather annoying. Also, sometimes it's not completely clear when soldering of components is supposed to occur or not. In terms of grouping components together and then soldering vs. soldering each component as you go. This could be clarified. However, to emphasize, these are minor complaints in the scope of things.

The next steps in the manual have me partially assembling the radio - installing the front panel, and control boards to the incomplete RF board and attaching to the bottom and side panels of the outer shell of the rig. Very exciting to see the radio come together this way. The purpose of the partial assembly step is to stage the components built thus far for some basic voltage and function tests (except for the SSB PCB, which is not installed at this point). So I completed the assembly steps, the Front Panel and the Control Board fit perfectly on the first try, the sides and bottom fitted without adjustment. I wired up a 13v power supply, connected everything up and.....

IT IS ALIVE!

WOW! Considering that I had doubts about some of my earlier resistance measurements on the Front Panel and Control Boards, I didn't expect the radio to come to life on the first attempt! While I did find that my measurements were OK for the Front Panel, I had doubts about the control board. None the less I didn't see a high risk to assembling them together and giving the voltage tests a whirl. Every measurement/test was perfect except one: The preselector button was supposed to trigger a relay for each of 3 settings. I heard a relay trip for only 2 of the 3 button pressings. So I may have a problem. I will have to email Elecraft on this because there are no troubleshooting notes that I can find that discuss the preselect switch/relay test.

07-Sep-06: Chatted with Elecraft on the relay issue. They offered guidance that the problem was either a damaged relay, a bad solder on one or more of the relays, or a crushed U01 IC pin. I found that one pin on one relay was not soldered. So I soldered it up, and the relay test worked just fine. Onward and upward.

17-Sep-06: Sorry folks - been having some joint trouble of late that has prevented me from continuing the build. Hope to be back at it in less than a week. I am too young to be this old!

02-Oct-06: For those of you following this build I offer my humble apologies for the delay in the continuation of this saga. The build has been interrupted by a rather severe inflammatory attack involving my right hand. I am unable to do fine detail work. Working with the Docs to try to get this under control - we thought we had it licked but I suffered a set back this past week. I have lost about 60% range of motion in my hand and have only 10% grip strength. I hope it comes back! Wish me luck, I need some. I will be back at the build just a soon as I can.

Stay tuned...

09-Jan-08: "Stay tuned" HA! Shortly I will be returning to finish the K2. I am going to resume by building the Noise Blanker and Automatic Antenna Tuner accessory boards. The reason for this is so that Rev A to B accessory upgrade parts for the main RF motherboard can be installed as I go. The mods are written assuming you already installed the Rev A version of the accessory and are retro-fitting Rev B. This is not the case with me, so I can avoid installing Rev A parts, and then having to de-solder and re-install Rev B parts just by walking through the accessory builds. I am rolling the dice a bit that this approach will not interfere with periodic PCB voltage and resistance testing on the RF board when it comes to it. Also, I have since upgraded my digital camera from a very dated and quirky Fuji to a Canon EOS 40 Rebel ATI. I expect that the quality of the pics will therefore improve. Some of the macro Fuji pics came out fuzzy (as you can see), and nothing I did would get the focus correct. With the Canon, I expect this will no longer be an issue.

12-Jan-08: Noise Blanker assembly. An afternoon lull allowed me to dive into the noise blanker assembly. Since I purchased my K2, there was an improvement released by Elecraft in the NB design, the parts for which I purchased from Elecraft. Therefore, the first steps in the build were to apply the modifications:

The remainder of the NB went together in a couple of hours. The Elecraft Manual stresses that this PCB is going to be installed with tight clearances, so I took special care in precision soldering. The manual recommended cutting the leads before soldering. I found this unnecessary (as long as your solder skills are up to the challenge) except for the reverse mounted 1/4 watt resistors.

A note on how to pre-cut component leads before soldering. After fitting the component through the PCB, I take an Exacto knife and lightly score the lead where it meets the surface of the PCB. Then I remove the component, and find the score mark under magnification, and snip at the score. Works every time.

I also discovered that I am missing a capacitor from the NB kit (C12 if you really must know), so I have sent a parts request off to Elecraft this evening. Other than the missing capacitor, the NB board is now complete.


A note on toroid windings. I count the windings four times under magnification - 2 times clockwise, 2 times counter-clockwise just to be absolutely sure I have the correct number per the manual. For tinning the leads, I have found that the best way is to very gently clamp the torrid after it's wound, and tin the leads with the toroid held this way. Without something to hold the toroid in place while you tin the leads (using the solder blob method), the toroid moves around too much. Care must be taken when clamping, because it is all too easy to crush the core. All you need is just enough clamping pressure so the component does not move with solder iron contact.

Up Next - the Auto Antenna Tuner accessory kit.

15-JAN-08: Automatic Antenna Tuner Build. Control Board Assembly

The Control Board is one of two PCB's that make up the Auto Antenna tuner. This is another cramped board requiring some care, but it was not all that challenging. The first page of installation went smoothly except for 1 capacitor. I carelessly installed the wrong cap. Luckily my check, double check, triple check approach saved the day, as I caught the error and corrected it. No harm except to my pride. Here is a pic of the board after Page 1 of instructions are complete:

I started assembling this board before I realized there was an errata page for the manual - which I (not so) smartly tucked into the back of the Ant. Tuner manual. Thus while thumbing through the manual looking ahead, I discovered the hidden Errata page. To my dismay there was a note on the work I had already done concerning R6. The Errata instructed not to install it, but of course I already had. The wording of the Errata suggested R6 was to be installed later, but I

couldn't find the note to install it, so I decided to email Elecraft and see if R6 was to be discarded. Less than two hours later, here is what Gary Surrency of Elecraft tech support had to say:

"R6 is left out for preliminary testing to prevent damage to the K2 PA transistors, if there is a problem with the KAT2 SWR sensor FWD detector output. This would cause maximum RF output with no indication of this on the K2's front panel. R6 later gets installed on page 17 of the KAT2 manual. Don't miss that step, and use care when first testing the atu."

I didn't see the note on pg 17 about R6, so I am glad I asked. R6 was removed and set aside without incident, and I continued on.

The next challenge for me was the winding and installation of T1. This component required 2 wires twisted together and then wound around the core. My problem was that one wire was colored red, the other green, and the resulting four leads had specific PCB pads assigned in a specific order...uh oh. As mentioned at the beginning of this blog, I am color blind in red and green. After contemplating this problem, I finally decided that the two colored wires had a sufficient enough shade difference that I could distinguish between the two without mixing them up. I guessed at which was red, and which was green. Here is a pic of the wound toroid. Note the leads - there was plenty of excess on this winding chore.  I had no problem tinning the leads using the solder blob method. Next I ever so carefully separated the two "red" and two "green" leads according to the Elecraft diagram, and after checking, and rechecking the orientation over and over, I soldered the component to the PCB. I think I got it right. 

After that tense work, there were only a few parts left to install before the board was complete. Here it is in all it's glory:

  Now time for the LC PCB of the Ant. Tune kit....

19-JAN-08: Automatic Antenna Tuner Build. IC Board Assembly

So onward I construct the 2nd half of the Antenna tuner. Overall, the compact antenna tuner assembly is a fun challenge to build. Lots of parts to solder, and some parts - especially some of the capacitors bent at 45 and 90 degrees require patience and a bit of finesse.

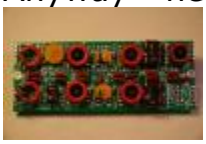
I soldered all of the 5v relays, with no problem....the suggestion in the manual to solder two leads per relay, and then reheat them to make sure the relays are flat against the PCP worked fine and I had no trouble here. In the final assembly there is ZERO clearance for these relays, so you better be sure they are as flat as flat can be on install.

Installing the capacitors was a bit tricky, since the bodies of the relays prevent you from soldering on the back of the PCB, but patience, a good solder iron, and an articulated magnifier is all that you need to do it right. Here is a side-on shot of the tricky cap installation, in the same orientation as the manual illustration:

Installing the toroids took time, but was not really a problem. Soldering the wires in the pads was the most challenging part. So far, I have really not found winding toroids all that terrible. It is tedious, but it doesn't take long to 'lace' up a toroid. And don't forget I count my windings four times, just to be absolutely sure they are correct. Most of the time here was spent ever so carefully trimming back the leads so that the toroids fit just right on the PCB. Six of the torroids on this board rest atop little rubber pads to prevent shorting. So trimming the leads to account for the rubber pad, soldering the leads, then installing the pads took some time. But like everything else in this kit, patience is all you need to get it right. Here I experienced another goof. While I was winding one of the torroids, it popped out of my hand and landed on the concrete floor, breaking in

two.  There are no spare cores in the kit, so I must send to Elecraft for a replacement. This of course will prevent me from completing the Auto Antenna Tuner assembly. But I can continue with the main RF board assembly while I wait for the replacement core, so it will not stop me. The enameled wire for these cores can be a bit on the slippery side, and I had a couple of these cores pop out of my hands as I wound them (only one broke) so if you are not working in a carpeted area, it's a good idea to put something soft down - a pad of some sort - and old thick bath towel - a carpet remnant - something soft. Note I have 'medium' sized hands, so the problem here was not fat fingers, but slick slightly springy wire.

Anyway - here is the finished LC Board with the one torroid missing....



Next are the two wire harnesses and then sandwiching these two halves of the Antenna Tuner together....on the next installment of This Old Kit.....

19-JAN-08: The Auto Antenna Tuner accessory kit is as complete as I can make it sans missing toroid. I did not have much trouble with the wire harnesses except that when you strip short lengths of wire, the insulator tends to slide. Crimping/soldering the individual pins for the connector was tedious small work. Couldn't have done it very well without the 5x magnifier. I have also started wearing non-prescription reading glasses for even more magnification for the tiny work. Here are several pics of the ATU assembly. In the far left pic below, take note of the clearance between the two BNC antenna connector bodies and the bank of 5v relays - there is none. When Elecraft says a component must lay flat on the PCB, they mean it!




Now, on to finish the RF motherboard....

24-JAN-08: Continued. RF MotherBoard Assembly

Now, on to finish the RF motherboard (still a ton of work to be done on this board)....

The resumption of work on the RF board starts with some 40+ 1/4 watt resistor installs. For me, this is the most perilous activity of assembly due to my color blindness. I am trying to be cautious, and measure each resistor before I install it to be sure it's the correct value. If I have erred on the VOM setting, then I could install the wrong resistor. Reds, browns, and greens all blend together for me, and of course many of these resistors have reds, browns and greens. After a 'major' section of work has been complete, I will post some pics of the work and a discussion of the challenges if any. Here are 3 pics of the resistors, resistor packs, as well as a few diodes that I installed:

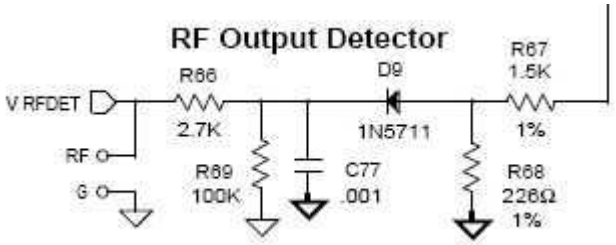


After the resistor install, the next grouping was for diodes, and here I encountered another temporary road block peculiar to my K2 build. As I mentioned at the outset, this K2 is an old kit. I bought it in 2000(!) and for one reason or another didn't start the build until 2006(!). The kit I bought was 'rev A'. I purchased a series upgrade kits to bring the rig to a 'rev b'. The rev b upgrade included a new manual in rev b vintage along with parts, chips, and new PCB's. Here lies the snag. Some of the diode part numbers to be installed starting on Pg 50 have changed since I bought the kit. Since none of the diodes in question came with the rev b kit, I should be able to use the Rev A parts that were designated for these diode positions on the PCB - right?.
Right. However, in the spirit of NEVER assume, I have emailed Elecraft tech support this evening to confirm this. I did try to find a reference guide on the web that might have indicated x part from this manufacturer equals y part from that manufacturer, but no luck. So, I wait for tech support's response. Based on prior experience, I should have a reply tomorrow.

24-JAN-08: True to form Elecraft responded this morning to my inquiry and provided a surprising answer - this exchange is proof positive that the only dumb question is the one that isn't asked. Here is what Tech Support had to say:

"The MVAM108 diodes are OK to use. They were just discontinued, so we had to get an alternate.

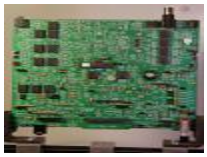
D9 was changed to a 1N5711 for better wattmeter accuracy. Resistor R68 also has to be changed to 226 ohms, 1%."



Waiting for parts to come to NJ from California is a bit of a pain (The missing capacitor and replacement toroid have not arrived via snail mail yet). I am going to see if I can get these components (except the toroid) from Lashen Electronics of Denville, or Wayne Electronics of Wayne. Anyone reading this blog that knows of another electronic component supplier in the Northern New Jersey area, please email me.

27-JAN-08: Examining the manual for the steps following the diode installs, I determined that there would be no harm in continuing even though I didn't have the IN5711 diode on hand. I discovered that both local electronics stores are not open on weekends, so I ordered the various missing parts from Mauser Electronics with the exception of the toroid....not enough info to order the toroid. Haven't received any parts from Elecraft yet - parts support turn around seems much slower than their five star tech support.

Here is a pic of the RF board after all assembly steps on Pg 50-51 are complete. These pages cover resistor installs, Diodes, and a few transistors:



Moving on to Page 52 - 53, which specifies a large number of capacitors as well as a several IC's and a few misc parts. Here I hit another snag. RF Choke RCF13 has a resistor-like body. There are several Solendial RF Chokes for this kit, and they come separated from the resistor packs (thank God). Also they are larger in size than the 1/4 resistors. However, the values of the Chokes are determined by color. **Uh oh**. There is a group of Chokes with Brown-Black-Brown and one Choke Brown-Black-**Red** - ugh. This is not helpful to the color

challenged. And I don't have any measuring gear that can help me out of this one. So, after studying these Chokes side by side for a long time under 5x magnification, I took a gamble on which were the Brn-Blk-Brn and the lone Brn-Blk-Rd. Below is a pic of the RF board after these two pages of assembly are complete, along with a close up of RCF-13. Did I guess right? I think I did. N2NO will no doubt tell me if I did good or not.


After Pg 53 of assembly, the Rf board is beginning to fill out nicely. I estimate it took me about 3-4 hours to complete these 2 pages. I am a little puzzled by the order in which parts are installed in these sections. Instead of installing all caps or resisters, diodes, transistors etc of the same value/type, the manual has you jumping around to all different valued parts. It may be six of one/half dozen of another, but I think it would be easier to install parts by component value - meaning - install all 103 Capacitors, then all 104 Caps, then 102 Caps and so on, rather than a 102 here, a 104 there etc. I think this approach would be better at preventing the wrong valued part from being installed accidentally. If I recall correctly Heathkit used to do exactly what I am suggesting. I would guess the good Elecraft folks are sick and tired of being compared to Heathkit, but.....sorry guys.

Anyway, I am assuming there is a method to the madness, so I am following the steps in the manual.

Note, I have lowered the resolution on the pics so they load a little faster. Resolution is now "high" as opposed to maximum resolution. I don't notice the resolution difference myself, but the pics do load faster.

03-FEB-08: Continued. RF MotherBoard Assembly

One thing has become clear by this weekend, my replacement parts requests to Elecraft apparently are not legit as far as Elecraft is concerned. Elecraft Tech support has been stellar thus far, but I am disappointed that no one from their "parts support" area bothered to reply to my requests and tell me I was on my own for replacement parts at this stage. Keep in mind this is an old kit I am building. Elecraft will supply parts

to new kit buyers that find parts missing after inventorying the kit upon receipt. In my case, this kit has been lying around for years, and has been half built for 14 months. But, I am being ignored by the Elecraft parts people. Getting a 'no' answer is perfectly ok, but not getting any answer at all is bad form. Having to buy these misc. missing or broken parts myself is no big deal. Being able to buy them from Elecraft guarantees that I get the correct replacement parts. This has not been a problem except for the toroid core I broke earlier. I can't find the core in the Mauser catalog to save my kit. So, I sent an email to Mauser asking for assistance. If not, there is another supplier I found on-line (Ken's Electronics) which sells the core, but they require a minimum order and all that. Let's see what Mausers has to say first.

On with the kit... I installed the crystals and grounded the cans per instructions. I used a pair of fine wire cutters to hold the wire in place while I soldered it to the top of the can. Then I soldered the ground wire to the PCB pad. This worked fine. For the five crystals that required grounding to the side of the can, I soldered these ground wires to the PCB first, then pressed the wire to the side of the can, soldering it. The instructions caution that the cans are very sensitive to heat. I did the best I could to solder quickly. We will soon know if I was successful or not.

Here are three pics of the installed crystals.



25-FEB-08: RF MotherBoard Assembly Continued.

I have been a busy little Ham of late. In addition to redesigning this web site, I continued working on the RF PCB. I have installed a lot of components since my last post. I am now up to the first series of alignment steps. I estimate the board is 60% complete. There were few individual operations worthy of notation during this phase of assembly. Just a lot of installs of capacitors, resistors, coils and toroids. A lot of close in work as the board is now getting pretty crowded. I found it easiest to solder one component at a time when installing those parts with very tight clearances


The trickiest operation of this series of component installs was a pre-manufactured toroid that is bridged by a resistor. The leads off the winding are very fine and hard to work with even under magnification. Here is a pic of this component:

Also in the spirit of grousing, the manual tells you to install piggy-backed Diodes

D16 & D17 on the bottom of the board. That's fine, but the manual doesn't say what the values of these diodes are, so you have to fish for the diode id's in the back of the manual. An annoying oversight that happens from time to time in this manual. Elecraft should never refer to a part with identifying it clearly within the install step instructions!

I am currently stymied from proceeding to the alignment steps due to a missing 4.7pf ceramic capacitor. I ordered replacements from Ken's electronics - they only had 5pf caps, but according to the Elecraft manual, 5pf should be fine. I also ordered another roll of fine solder. Doing so produced this news flash - Ken says "the price of solder is skyrocketing". Take note kit builders and homebrewers, stock up on solder now. The Chinese are still driving the price of raw materials up, up and away (that and the declining dollar are a double whammy)! In addition to this, I also ordered the pesky missing toroid core. I expect these parts to show up this week.

25-FEB-08: RF MotherBoard Assembly Continued.

We interrupt this K2 build to bring you this portable antenna assembly

Because I am stalled waiting for a lousy rotten 5pf capacitor, I decided to fill the time constructively by assembling the K2's future portable antenna. I recently purchased a Pacific Antenna PAC-12 portable multiband vertical. Assembly is required - particularly the winding of the coils and radials. In this case, I purchased the kit in 2 coil flavor, plus I purchased the 80m accessory coil. Of course, you can buy additional coils for additional bands, and I will eventually do just that.

What attracted me to the PAC-12 was it's compact size, and the fact that most reviews on Eham.net were strongly positive. So, I wound the 80m coil, then choose the other two coils to wind for 40m, and 20m. Therefore, this is a tri-band vertical. It is not in true multi-band vintage, so the coils must be swapped out for each band, which is no big deal for a dedicated portable antenna. The assembly instructions were easy to follow.

Here are pics of the antenna. While I have assembled it, I have not tuned it yet as I am short on coax. So, that will have to wait until I can pick some up at the Split Rock Hamfest coming up this weekend. I will tune the coils using my Yaesu FT-1000MP, since the K2 is unfinished. And I will try to optimize the SWR for the CW band. I will probably elect to build separate phone coils if these are not broadbanded enough. Certainly this will be required for 80/75m. Note that the top section of the vertical is a telescoping whip that is collapsed in the picture below.





08-Mar-08 - RF Board Alignment

The missing capacitor arrived and was installed. Next was the initial resistance checks which were ok. After that a series of alignment steps for the PLL, VCO, BFO and IF circuits. Here I hit a snag. Everything was going great until the last step - the IF alignment - No audio. The receiver wasn't working!

I am not a hard core homebrewer. The only test gear I own is an aged Fluke DMM, though I used to own more test gear in the distant past. I don't have a lot of rainy day money lying around to run out and by a signal generator, a frequency counter and maybe a nice oscilloscope. In addition, since this is the first kit I've built in 20 years or so, there is a heavy coating of rust on what skills I had to read a schematic, and troubleshoot a broken circuit. But - here it goes.....

I browsed the Elecraft website looking for troubleshooting tips and found Tom Hammond, N0SS's tutorial on "Cheap and Dirty signal tracing". So, I built his cheap and dirty signal tracer. Cheap as dirt, because all it is a 100pf cap placed in line with a working antenna. The Cap becomes the probe. How cheap and dirty can you get!?

First, using the suggested test points by N0SS, I got no signal at any of his recommended test points. Next I turned to the schematics and tried a few points at random more or less 'in the middle' of the receiver circuit. I found a signal at jumper W2, and started tracing from there. This ultimately led me to discover two missing parts - Z6 and C167. What is Z6? Oh, nothing much except the receive mixer!!

So I installed Z6 and C167, and I now have audio in the headphones. However, the audio is quite low. Even though I was able hear well enough to complete all of the alignment steps, I am going to pause here until I am satisfied the audio issue is fully debugged.

11-Mar-08 - Talked to Elecraft about the low audio. They suggested I finish the kit and then troubleshoot the low audio after the rig is fully aligned. So...onward!

30-Mar-08 - RF Board Assembly Continued

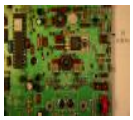
Life has been getting busy for me now that spring is here. The kit build was interrupted while I prepared to host a family gathering for Easter. However, before this I managed to install much of the remaining components on the RF board. Thankfully, there were no additional missing part issues. No really notable component challenges for this round - just a ton of resistors, capacitors and a few transistors to install. Elecraft does not instruct on whether to install and solder one component at at time or not. I decided to solder these components one at a time because of how crowded the board is getting. I think this was the right way to go.

Now I am at the final stages of the RF board assembly. Elecraft reserved a large number of toroids for the end of the kit. I have wound all the band pass filter toroids and installed them. I am currently working on the challenging double wound T2 core. I wound it incorrectly the first go. Subconsciously I must have known T2 was wrong because I spontaneously decided to recount the windings after I installed it. So, after discovering that I was short a winding, I had to uninstall - a total pain - and T2 is now waiting to be re-wound. After T2 is re-done, there are only a relative few more components to install, and I am done! Here are front and back pic of the board just before I started on the pass-band filter windings:

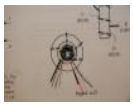

09-Jun -08 - RF Board Final Assembly

So, after yet another break to take care of other stuff I have going on, I am now in the home stretch of motherboard assembly. These last handful of steps are difficult.

As I mentioned in the previous post, T2 gave me some trouble as I wound it improperly. I have since gone back and re-wound and installed it. (Note in the following pic, T2 is centered in the pic to the right of the T3 PCB outline.)



After T2 comes T3 - a larger torriod with a twisted pair of windings. I tried to make the torroid look like the pic in the manual as much as possible before installation:



This one was tricky due to the placement of the leads on the pcb relative to the red and green wires. Lest we forget, I am color blind so sorting out the two wires for proper PCB placement was a challenge, but I am confident I got it right.

After T3 comes T4 oddly enough. I haven't mounted this one yet because the manual cautions that T4 is permanently mounted over two set screws which support a small aluminum mounting block for the outer case. Since we don't want this coming loose, I am going to pick up a tube of red lock-tite to ensure those little suckers stay where they are.

04-Jul -08 - RF Board Final Assembly

THE K2 BUILD IS COMPLETE!!

All pcb board construction is now finished. As I mentioned these last few assembly steps were some of the most difficult, with T4 being the toughest of all, but I did it

Here is a pic of the component side of the completed Motherboard:

Here is a pic of the solder side of the completed Motherboard:

After re-assembling the basic rig components into the chassis, the first step is to do a few resistance measurements. All but one measurement was nominal. The manual doesn't offer any instructions on what do if a resistance measurement comes out abnormal, so I emailed Elecraft. They told me it was probably nothing and I should continue with final alignment.

So, ready for initial transmitter alignment, I sat down to take the plunge, and realized I overlooked something important....I don't own a dummy load!! Yeah, that's right, I am building a kit all these years, and I don't even own a dummy load. Well, now I do. I bought Elecraft's 20w dummy load. Now I can align the transmitter. The initial alignment went smoothly with no problems.

After the xmitter alignment, Elecraft has you go through another receiver alignment step, which I did, but with mixed results. Maybe I am going deaf in my old age, but I could not hear any signal noise difference for almost all the bands as I tuned the coils. This worries me a bit, but on the flip side, I am able to hear signals, so.....I dunno. As I've have mentioned before, I think the audio output is a bit weak. I still think there is something going on with the receiver. I will have to do some debugging I think. But for now, I set the weak audio issue aside to continue alignment.

The final xmitter alignment steps are next, These I did not have a problem with.

And the rig is now ready for basic operation & use. However, I purchased a number of modules that need to be installed. While Elecraft recommends you play around with the rig in basic configuration for awhile to get used to it. I am too impatient. So I am starting to install the modules.

Because it's one of the smallest, I decided to install the 160m/2nd RX mod first. Installation was a breeze. No problems found other than one - I don't have an 160m antenna! So obviously this mod was for future use, so I did not go through all the 160m alignment steps at this time. I did put the 2nd RX antenna connection through it's paces to make sure it worked. It does. Here is a pic of the partially assembled radio with the 160m/2nd RX mod installed in the upper right back corner of the rig:

This is where I've stopped for now. Still to install is the noise blanker, the Auto Antenna Tuner unit, the SSB module, and the battery pack.