TAPR #98 WINTER 2006

PACKET STATUS REGISTER

President's Corner

What's in a name...

Some of you may have noticed that we've been referring to ourselves (more often than not) as TAPR rather than the Tucson Amateur Packet Radio Corporation, and wondering why. Again, some of you have already gleaned the answer – we're not just about packet radio anymore. And we haven't been just about packet radio for quite some time. What we've always been about is bit-banging and finding ways to do that effectively. Thus, we've been involved or interested in modems and radios that allow amateurs to do that more efficiently.

Thus, by extension, we are interested in all of the digital modes, and you can find our membership participating from the "DC" frequencies up though the microwaves.

Surprisingly, some folks have developed a little heartburn over our apparent abandoning of our "roots" insofar as they see us as no longer "doing packet radio." Nothing could be further from the truth. If you have a look around a Digital Communications Conference, you'll see packet radio everywhere – laptops running 802.11! This is an offshoot of our pioneering work and something we should be proud of, and it is appropriate that we turn the considerable talents of our group towards new horizons.

Our latest batch of projects supports the experimenter with a number of interesting test equipment applications. The whole line of Time Signal and Time Base kits by John Ackermann are well worth your consideration this year. While they are not for everybody, and some are highly specialized, I think we could all benefit from dabbling in these kits. As well, the VNA is now being sold by Ten-Tec, and I'd encourage you to look into this amazing little box, resplendent with the TAPR logo on the front grille.

And again, here is an example of how the membership can get support for their ideas. If you have a project or idea, bring it to us and we can assist you at whatever level you might feel necessary. You don't have to be an expert in board layout or full circuit design, but you **could** be by the time you finish a project!

So the next time you hear about us referred to as "just TAPR," remember we're not just packet radio anymore. We're much more.

And we get articles …

We had a comment from a member who disagreed with a recent article published in *PSR*. He felt that TAPR should not support the position of the author, and that the article had been too long.

First, members are entitled to publish articles in *PSR*, and the simple publishing of the article does not imply support by TAPR for any positions or conclusions reached within that article. Members (and guests) are permitted and encouraged to respond with alternative points of view. While I do share a certain preference for brevity, some topics obviously demand a broader canvas, and we are not here to stifle expression.

Again, I want to emphasize that the mere publishing of a submitted article implies neither the support nor endorsement of the expressed position of that author by TAPR or the editor.

No editor in his right mind is going to turn down any article with reasonable content. If an article is controversial, some useful debate might ensue. I'm sure that Stan would be thrilled to be in a position wherein he would actually have to pick and choose what he has room for.

At any rate, articles from you are going to be more interesting than long diatribes from me!

Dayton 2006

Well, we're going to be there, are you?

We'll have our usual presence this year, with a booth, and we will once again be hosting the Digital Forum. There will be the Packet Bash (speaker to be announced), and we plan to host the Wi-Fi in the Hara Arena this year.

Drop by the booth, and give us your thoughts.

2006 DCC and the TAPR Homecoming

We are currently shooting for the weekend of September 15-17 in Tucson, AZ for the 2006 edition of the Digital Communications Conference (DCC).

We plan to invite TAPRites, past and present, to join with us in celebrating 25 years of TAPR. Details will be up on the web page **(www.tapr.org)** shortly...

Be there, or be Analog.

Dave VE3GYQ/W8

###

Icom D-Star Today

By Matt Ettus, N2MJI

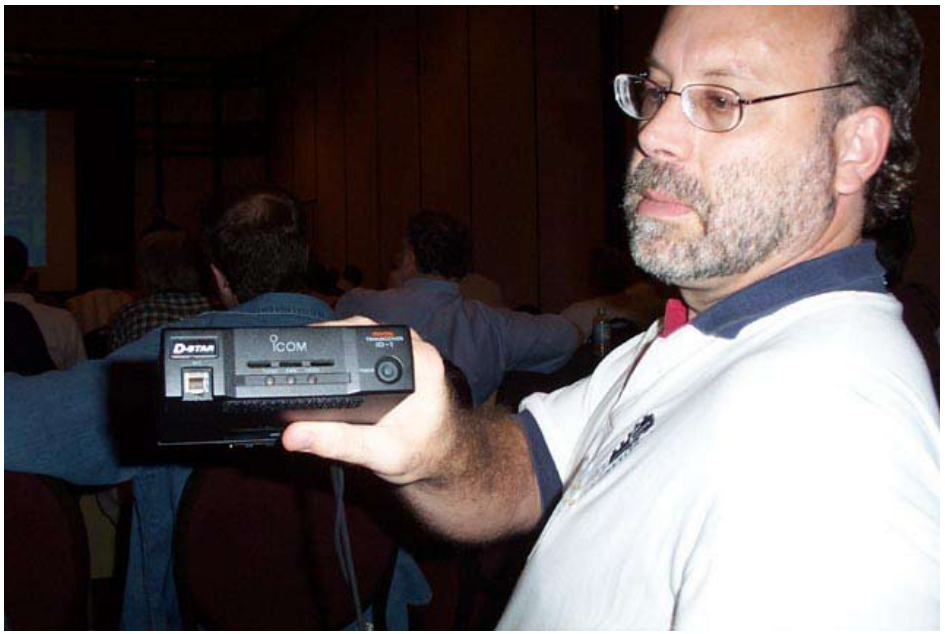
Icom donated the following D-Star equipment (www.icomamerica.com/amateur/dstar/) to TAPR: Repeater Controller model ID-RP2C, 1.2-GHz voice repeater model ID-RP2V, 1.2-GHz data repeater ID-RP2D, and 1.2-GHz mobile radio model ID-1

In association with TAPR, the GNU Radio project (www.gnu.org/software/gnuradio/) is using this equipment to develop an interoperable implementation of the D-Star protocol in free software. The hardware platform is the Universal Software Radio Peripheral (USRP).

The GNU Radio project now has a working implementation of GMSK (Gaussian Minimum Shift Keying) data as used in the D-Star system. We also are able to send and receive digital voice packets using the GSM full-rate voice codec, which is completely open source.

The next steps are to generate and parse D-Star protocol packets, and figure out a way around the proprietary AMBE voice codec that Icom chose to use. The repeater will be set up at the Stanford Radio Club (W6YX) site in Palo Alto, California, once a suitable 1.2 GHz duplexer is found. Any leads on obtaining one of these would be much appreciated.

###



TAPR Director Steve Bible, N7HPR, examines an Icom D-Star.

SuitSat-1: The Unique Talking Satellite

By Steven Bible, N7HPR, n7hpr@tapr.org

By now you have probably heard about SuitSat-1, the unique talking satellite sponsored by ARISS. If you haven't, check out the following web sites: **www.amsat.org/amsat-new/articles/BauerSuitsat/index.php** and **www.aj3u.com/blog/**

SuitSat-1 was deployed from the International Space Station at 2302 UTC February 3, 2006.

I had the pleasure of being involved with this unique project. I received a phone call from Lou McFadin, W5DID, ARISS Hardware Manager, asking if a microcontroller could be used to control the various functions from a satellite. I gave him a resounding "yes," as I was confident that it could be done. Thus began the journey of turning an out-of-service Russian Orlon spacesuit into an amateur satellite.

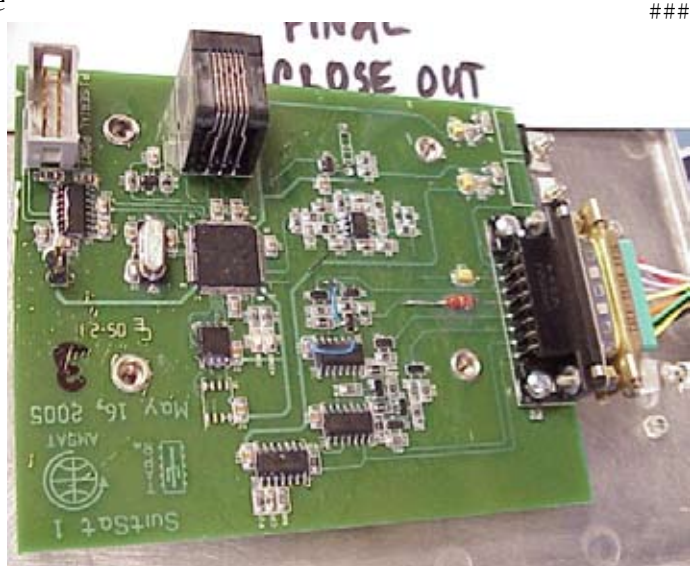
The main mission of SuitSat-1 was to commemorate the 175th anniversary of the Bauman Technical Institute in Moscow, Russia, and to provide a platform to interest children of all ages to the wonders of math, science, and technology. What was conceived was a satellite that would be easy for anyone to receive with a handheld transceiver and a handheld antenna, such as an Arrow antenna.

The microcontroller with external serial flash memory stores and plays back recorded voice using an encoding technique called Adaptive Pulse Code Modulation (ADPCM) that effectively compresses voice, yet giving toll-quality playback fidelity. Each of the recorded messages was made on a computer, capturing them in a *.wav file. That file was converted to an unsigned integer raw file, and then encoded into an ADPCM format binary file. The binary files were then stored in the serial flash memory using a simple file system to address each voice file individually.

One of the neatest functions of the satellite, I think, is the talking telemetry. SuitSat-1 speaks the mission elapsed time in minutes, temperature, and battery voltage. The ability to individually address the voice files allows a flexible way to say the words associated with the time, temperature, and voltage. For example, temperature is read from the temperature sensor. The binary value is parsed and used to address the associated voice clip, and played. Thus, the temperature is spoken, "the temperature is twenty-seven degrees Celsius." The sentence is several phrase files, "the temperature is," "twenty," seven," "degrees Celsius."

Interest in SuitSat-1 has been phenomenal. The web site **www.suitsat.org** was set up by Steve Dimse, K4HG, of **www.findu.com** fame. The site received 2 million hits the first weekend that SuitSat was in orbit. Take a listen to the many recordings people around the world have captured on the AJ3U web site mentioned above.

###



The microcontroller PCB of SuitSat-1

TAPR TADD Projects

By John Ackermann, N8UR, n8ur@tapr.org

I've long had an interest in time and frequency measurement and there are a surprising number of other "time-nuts." In fact, the **time-nuts@febo.com** mailing list that I sponsor has well over 200 members.

eBay and other sources have made lots of really excellent frequency standards, counters and similar gear available at prices within a ham budget. But as you get into the hobby, you will find that there are a number of useful gadgets that are hard to come by.

For example, a frequency standard often has only one output and if you have multiple devices that want to use it, you will need some sort of distribution amplifier. That's one device that is fairly rare on eBay. There are work-arounds like TV splitter/amplifiers, but they really aren't designed for this use.

Another hard-to-find item is a frequency divider. It's easiest to do high precision, long-term measurements using low frequency pulses (usually 1 pps) and that means you need a circuit that can divide a high frequency signal down to that rate. Dividers are very uncommon on the surplus market and, while in theory it's easy to build one by cascading some divider ICs, you'll find that those circuits are very temperature sensitive and have a lot of jitter.

The TAPR "TADD" projects are designed to make accessories like these available to the time and frequency community at a reasonable price. There are currently three TADD units either available or in advanced development, with others a little further down the road.

TADD-1 RF Distribution Amplifier

The first kit, the TADD-1, is shipping now. It is a distribution amplifier that accepts an RF input from 200 kHz to 30 MHz (it will work outside this range, but with lower gain) and provides six outputs. It's not designed to have a lot of gain, but the output amplifiers are pretty solid and are designed to drive coax cables. Each output is separately buffered and is transformer isolated to avoid ground loops.

Its primary purpose is to allow a single frequency standard to drive multiple devices. Although it's a broadband device, the board includes provision to install an optional bandpass filter if you want to clean up the input signal (e.g., you are using a square wave source but would like a nice sine wave output).

TADD-2 Frequency Divider

The second kit in the series, the TADD-2, is a frequency divider that is currently under development. It will use a complex programmable logic device (CPLD) to accept input frequencies of 100 kHz, 1 MHz, 2.5 MHz, 5 MHz, or 10 MHz and provide a 1-pps output with low jitter. Actually, the board will provide outputs from 1 pps through 100 kHz, and has additional features like programmable pulse width and delay. The dividers can be synchronized to an external 1-pps pulse to allow "setting" the 1 pps to an external clock. TADD-2 will provide six outputs, each of which can be set to any of the available output frequencies.

Since the CPLD is a field-programmable device, its code can be modified for other applications using free tools available from the

manufacturer (Xilinx). The TADD-2 source code will be licensed under the GPL.

The TADD-2 is still in the design phase, but should be available June.

TADD-3 Pulse Distribution Amplifier

The TADD-3 is a PPS distribution device. It accepts one or two pulse inputs and provides eight outputs: six via BNC connectors and two RS-232 level outputs that can drive a computer serial port. The input is configured to accept a TTL level input or through the use of on-board comparator chips, other signal levels. Using the comparator input will increase jitter and delay, but less than one might think. Each output can be jumpered for normal or inverted output polarity. The TADD-3 design is finished and we have the parts for the initial kit run on order. We plan to formally announce it and start taking orders sometime in April.

Other TADDs

Two other TADD projects are designed more for RF experimenters than time-nuts, though there's plenty of overlap between the two groups! The TADD-4 and TADD-5 are antenna coupler/preamps.

The TADD-4 is simply an amplified coupler that allows six receivers to be driven from one antenna while providing high isolation between receivers. It also includes a low-pass and optional high-pass filter to help knock out strong broadcast stations.

This project grew up out of my experiences with the ARRL Frequency Measuring Test, where several local hams bring their equipment to my basement to run probably the world's only multi-multi frequency contest station (see **www.febo.com/time-freq/fmt** for more details). We found that passive splitters created a lot of loss and didn't protect one station from interfering signals generated by the others. The TADD-4 provides extremely high isolation between ports and has a preamplifier to compensate for splitter loss.

The TADD-5 is designed to work with the USRP (Universal Software Radio Peripheral) from Ettus Research (**www.ettus.com**). The USRP provides the basis of a very flexible software radio, but does not have a front end for HF that provides the gain and selectivity needed for real-world use. The TADD-5 is simply a TADD-4 with additional gain (about 30 dB all told) and a bandpass filter on each output channel. The four antenna inputs on the USRP can be wired to four of the TADD-5 outputs to allow simultaneous reception of four ham bands.

The TADD-4 and TADD-5 should be available in the late summer.

Two final projects are more ambitious and may or may not see the light of day. They are specialized boards used for measuring the short-term stability of oscillators and oscillator phase noise. Neither of these projects has moved beyond the conceptual design stage, so I'm not making any promises about if/when they will be available.

Common Characteristics

The TADD family products all use the same form factor: a 6x4-inch board with six BNC connectors on one long edge and one or two BNC connectors, as well as a power input on the other edge. They all operate from a nominal 12-volt DC source and are designed so multiple boards can be stacked, sharing a common DC and (if appropriate) RF input. We hope to make an enclosure available that will work with all the different boards in the series.

As a final note: these projects are my initial attempt at PC board layout using computer tools. I'm amazed at how easy – and how much fun – it is to design a board with the tools that are available today. And, with several companies offering low cost prototype PC board fabrication, there's no excuse not to turn your idea into a working board. Give it a try!

###

CT1DMK Reflock II

By Steven Bible, N7HPR, n7hpr@tapr.org

The CT1DMK Reflock II builds upon the successful Reflock I designed by Luis Cupido, CT1DMK. The Reflock II can discipline a variety of oscillators up to 150 MHz or 1.1 GHz with an optional frequency divider. The reference oscillator can be a variety of oscillators, for example, 10 MHz from a surplus HP Z3801 or a GPS timing receiver 1 pulse per second (PPS) signal.

The Reflock II provides a flexible platform with its ability to reprogram the CPLD (Complex Programmable Logic Device) and jumpers on the PCB. Presently there are two major firmware programs:

- *r2_flex_01* – Reflock 2 flexible version 01 can discipline virtually any frequency oscillator by setting the R and N jumpers with a 10 MHz reference.
- *r2_enhpps_30_1* – Reflock 2 enhanced 1PPS version 3.01 can discipline virtually any frequency oscillator using a 1PPS signal from a timing GPS receiver.

Other enhancements include a serial port that can be interfaced to an external microcontroller to communicate with the firmware program in the CPLD. This allows status words to be received and the precision of the oscillator disciplining to be displayed. Three voltages are available from two-pin Molex connectors: 3.3, 5, and 12 volts. These voltages can be used by the interfacing circuitry to minimize the number of components of the oscillator system.

CT1DMK Reflock II kits are available now from TAPR. Bare printed circuit boards or kits of parts with the CPLD soldered to the bare printed circuit board are available. An assembled version is in the works. Ordering information is at **www.tapr.org/kits_reflock_ii.html**

Firmware for the Reflock II is available from CT1DMK's Reflock web site: **gref.cfn.ist.utl.pt/cupido/reflock.html**

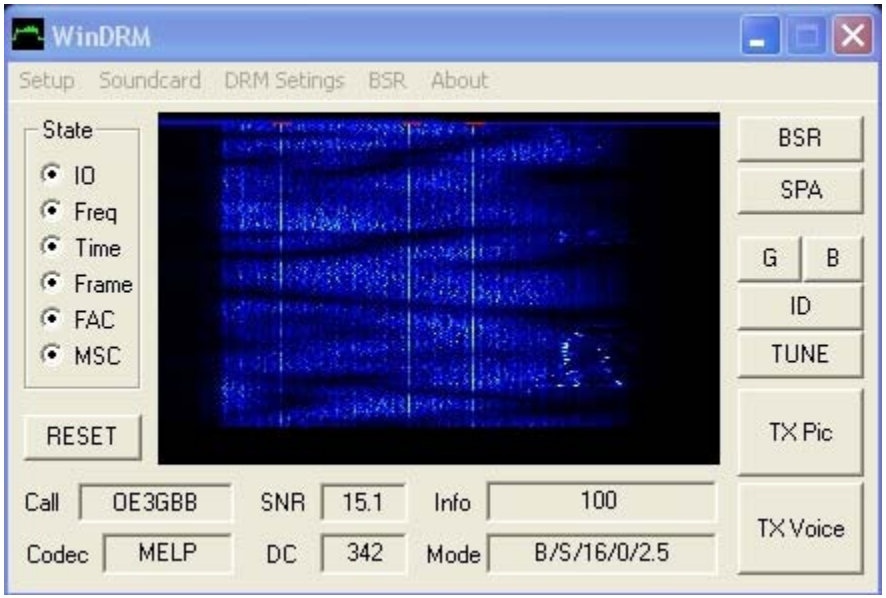
Instructions on how to set up the jumpers on the Reflock II for the various modes are available in the accompanying text files.

Discussion of the Reflock II and precision timing topics are on the TAPR "time-freq" mailing list. You can subscribe at **https://lists.tapr.org/cgi-bin/mailman/listinfo/time-freq**

###

HF Digital Voice Has Arrived!

By Mel Whitten, KØPFX, k0pfx@tapr.org



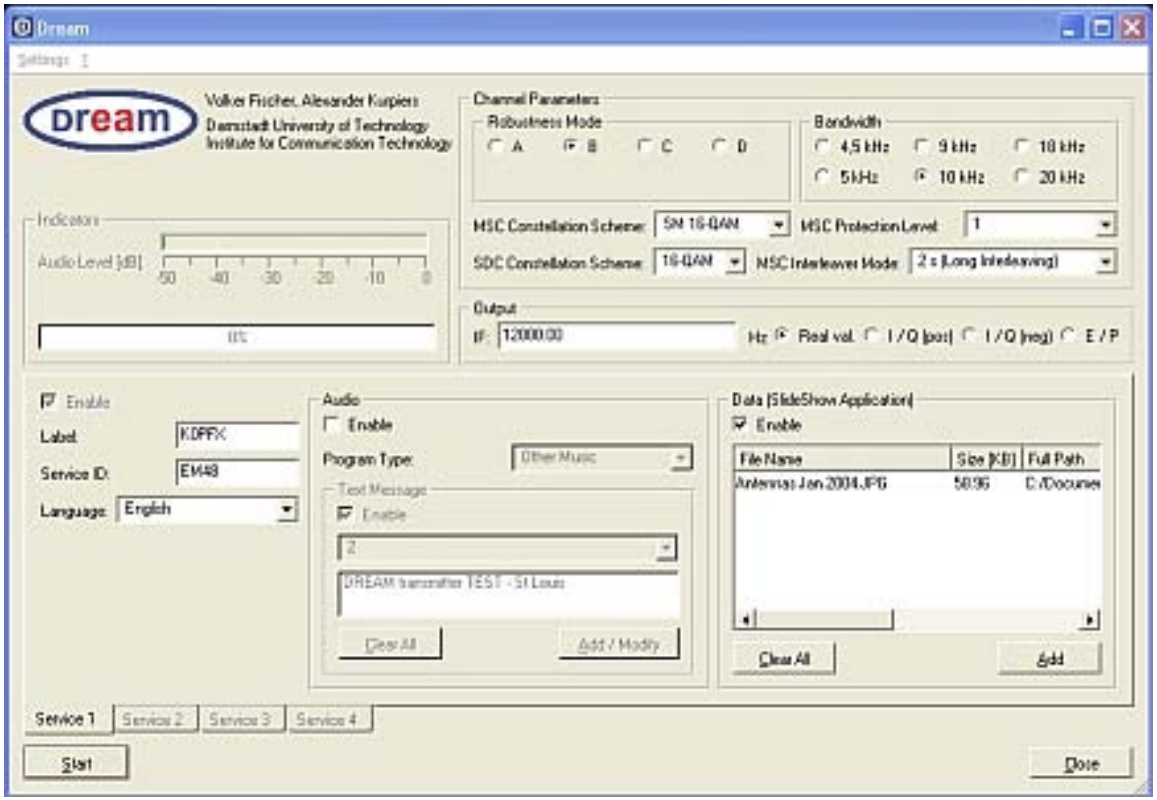
A 20-meter DV QSO with Gerhard, OE3GBB, 8-Jan-06, received at KØPFX

WinDRM

Since my DV update in the autumn 2004 TAPR PSR, I am happy to report that Digital Voice using *only* a sound card and *WinDRM* software is beginning to show some promise for HF work. This has been made possible by a number of enhancements in the code by Cesco, HB9TLK, and an additional CODEC. The GUI has had several facelifts with many new features, while maintaining a small footprint on the desktop. PTT may now be controlled with the spacebar (TX/RX toggle like *Echolink*) or your station's PTT switch with a simple com port interface.

To avoid hearing the OFDM data while in receive, *WinDRM* control may also be used to mute your speaker after the FAC (Fast Access Channel) time/frequency has been acquired. A PCI sound card (or even a noisy AC 97 on-board) and a media USB audio adapter have shown to provide the best audio for transmit and receive audio. This combo minimizes latency and echo normally associated with this type of audio application. USB 2.0-to-audio adapters are now very low cost, some selling for less than ten dollars (**www.geeks.com**).

WinDRM and documentation may be found at **www.n1su.us/windrm** and a mailing list at **groups.google.com/group/WinDRM**. Take a few minutes and try this mode, it might surprise you!



Digital Radio Mondiale - DREAM Transmitter

DRM's DREAM

Experiments transmitting DREAM 1.6 cvs have recently been made at 4.5, 5.0 and 10 kHz bandwidths with Flex's SDR-1000. The DREAM transmitter/receiver is fully functional and provides the experimenter a multimedia play ground for voice, text, data/pictures. DREAM's forum may be found here: **drm.sourceforge.net/forums**.

###

EMCOMM Easytenna

By John Kraus KC4ZGQ, digital_comms_ga@cox.net

This document details how to build an easy to install multi-band dipole type antenna for emergency communications using the NVIS (Near Vertical Incidence Skywave) propagation mode.

History

The NVIS mode is one in which the design goal is to enhance a HF antenna's radiation pattern in the vertical plane, while minimizing low angle radiation. This is normally done by reducing the height of the antenna.

When height is optimized for NVIS propagation the pattern becomes essentially an omnidirectional with coverage from 200 miles to 400 miles radially from the transmitting station depending on the frequency in use. This makes this type of antenna exceptionally functional for Emergency communications at ranges beyond normal repeater coverage on VHF/UHF frequencies.

This mode also excels in mountainous terrain since the signal is essentially returning to earth from directly overhead. It allows teams or groups to communicate even when hills or mountains intervene.

Project Goals

1. Given that a standard dipole at the proper height is a proven NVIS performer, it was chosen as the basic design for this project. Therefore, the project focused less on the actual antenna and more on the construction method.

2. Produce a coax fed center point module that allows easy exchange of radiating elements in the field without the need to disassemble the antenna completely. Allow for the use of any available coax without the need for attaching coax connectors in the field.

3. Design for dual-band operation without the requirement of a tuner.

4. Design an easy method for fine-tuning the antenna to suit variances in environmental or ground effects.

5. Design a system that can be deployed without the need for existing support structures. The design should allow for easy (less than 30 minute) assembly and deployment by one individual.

6. Achieve an overall package size that can be easily transported in even compact vehicles. This means no part can exceed a maximum length of 5 feet. The overall package should weight less than 20 lbs.

Construction

Assemble the center point from a PVC pipe cap and 1/8-inch brass compression unions. I inserted the center part of the union from the outside of the cap into a tight hole that was drilled undersize and opened using a tapered reamer. I then used a soldering gun to embed the hex collar of the part into the PVC cap. This helps prevent the center part of the union from rotating when attaching the radiating elements.

I provided for two bands, but three should also be workable. I used 14-gauge THNN stranded house wire for the hookup. To make a strong joint I tinned the wire, then bent the end over to form a nub that fits tightly in the compression collar. Then I solder the compression collar using adequate solder to form a secure fillet around both ends of the compression collar. Be sure to slip the compression nut onto the wire first. I then used a European style power bus connector to provide a secure connection for any type of available coax. This also allows easy assembly and disassembly.

Figures 1 – 6

I used a 12-inch section of 1-1/2-inch schedule 40 PVC for the base part of the center piece. It is not cemented to the cap in order to provide for easy disassembly

I inserted an eyebolt in the cap to provide a means of hanging the center piece of there is an available support. After I had a break in the field, I added a small section of 1/8-inch brass tubing to keep the wire from being stressed at the union nut.

Figures 7 – 10

This is a complete set of 20-meter radiating elements. The Velcro wraps are color-coded by band.

The end insulators are attached to regular bare stranded 14-gauge antenna wire on which I have threaded a single section of European style power bus connector. This allows easy attachment of 6 to 24 inches of wire to allow tuning with in a given band to compensate for environmental differences. It can also allow for the easy attachment of a random extra length of wire to each end that can be trimmed to resonate the antenna on a lower band. For example, the 20-meter elements can easily be extended to allow operation on 30 meters, while 40 meters can be extended to allow 60 or 80-meter operation.

Below is a close-up of the end assembly. The European style power bus connectors are perfect for this type of use since the large size can accept two 14-gauge wires in parallel and uses two set screws to provide mechanical security and electrical connectivity. If a nut breaks, it is possible to strip the insulation and insert it into the end fitting and still work. Another thought is to have an extra set of 40-meter radiating elements. At night, simply lower the ends of the antenna and add the elements to move the antenna to 80 meters. The bare wire ends allow a short length of wire to be added to improve the match so the actual length of the elements is better too short than too long; 31-32 feet should work well for 40-meter elements.

Figures 11 – 14

The center support of the antenna system consists of a 16-ft extendable painters pole. This was the most expensive part of the system and cost about $25. An alternative would be a third pole like the end supports, which would drop the cost somewhat. The pole is installed in a folding wooden park on mount that includes clear PVC tubing on the U-bolts to prevent excessive tightening. The end of the pole has a section of 1/2-in Schedule 40 PVC that has been heat expanded and driven down over the end of the pole. This allows antennas to be easily slid on and off and allows attachment of a vertical VHF antenna if desired.

I also have a 300-ohm twinlead J-pole antenna that has been installed in 1/2-in PVC that attaches directly to the pole. Both antennas can be use at the same time if the HF antenna is attached with hose clamps rather than slid directly over the stub.

Figures 15-17

The end supports are made from 10-ft long sections of 1-1/2-in Schedule 40 PVC. To enhance portability, I cut each section in half with a hacksaw and used PVC compression fittings to allow reassembly. These fittings are stronger than simple friction collars. It is also possible to glue a wooden dowel inside one section and bridge the connector but I have not found it to be necessary yet.

I use a Schedule 80 PVC pipe flange to make a foot for the base of each section. The holes could be use with large spikes or rebar to prevent slippage.

Each support is capped by a PVC tee fitting that is not glued.

The support ropes are 100 feet long 3/8th-nylon, although any rope will do. It has a large loop in the center that is slipped through the tee when it is off the pipe and then looped back around the pipe. This prevents the pipe from drifting sideways during erecting.

Figures 18-22

These shots show the entire system laid out on a table. The yellow wraps are 40-meter elements. The green ones are for 20 meters. The system can be installed in less than 30 minutes by one person without any climbing or throwing ropes into trees. It does require some form of anchoring system for the end support ropes, but even curb bumpers can be used if the rope is wrapped around them.

With a center height of 16 feet and ends at 10 feet, the antenna is at near ideal NVIS height for most HF bands where this mode is an option. Furthermore, it places the antenna wire high enough that most cars and pedestrians traffic is not at risk. It is possible to assemble the system with the antenna at about a level 5 feet, but this requires more care to isolate the antenna from casual contact. All of the parts, with the exception of the poles, are easily stored in a 2.5 gallon Ziploc bag. This includes 60 feet of RG-8x with a PL-259 and pre-tinned ends and 100 feet of RG-58.

Below are some shots of the antenna system setup in my backyard. In this shot the center pole is at its lowest position.

Figure 23

###

Southwest Ohio Digital Symposium A Success!

By Hank Greeb, N8XX, n8xx@arrl.net

More than 75 digitally minded hams got together at Miami University, Middletown Campus, Middletown, Ohio, on Saturday, January 14th, for the 20th Annual Southwest Ohio Digital Symposium. This event is the second longest continually running digital "mini-vention" in the United States, longevity only surpassed by TAPR/ARRL's Digital Communication Conferences (DCCs).

There were seven presentations on topics ranging from "Nuts and Bolts of Echolink" to "A New Terrestrial Record for 2.4 GHz 802.11b Communication." John Ackerman, N8UR, past president of TAPR, spoke about the "GnuRadio and the Universal Software Radio Peripheral." For more details on the event, see **www.swohdigi.org**.

We are currently searching for new leadership for this symposium/conference. Hank Greeb, N8XX, has moved to Michigan, and Carl Morgan, K8CM, is semi-retired from the faculty at Miami University. If anyone is interested in keeping this event going, please contact **n8xx@arrl.net** or **k8cm@qsl.net**.

###

Can AX.25 Be Saved? (Should It Be?)

By Pete Loveall, AE5PL, pete@ae5pl.net

Back in the late 1970's, some forward-thinking Amateur Radio operators got together and began to formulate what would become AX.25. They saw the need to look beyond the simple keyboard-to-keyboard communications already available via RTTY. They were also aware that other disciplines (commercial and institutional) were developing protocol standards such as the OSI 7 layer networking model.

Being good hams, they looked for commonly available hardware upon which to base the physical (RF) part of the protocol. They also looked at protocols already developed and decided upon the X.25 suite of protocols (X. protocols) to use as a basis, with variations more apropos for Amateur Radio. Out of this, we got the AX.25 Layer 2 protocol (link layer) that could be used by itself or in conjunction with other protocol layers.

Since the acceptance of the 2.0 specification in 1984, many networks have come and gone. One thing has remained constant: amateurs have continued to create unique applications and unique protocol adaptations, which are not compatible with each other. Unfortunately, this unique approach has severely restricted the usability of AX.25 networks, especially to the transient user. The net result: most AX.25 networks have faded away and those that are left are difficult or impossible to use for the traveling ham and can't be used across applications.

TAPR has established a special interest group for investigating AX.25 as a true, generic Layer 2 protocol. Membership includes the author of the 2.2 specification along with other software and protocol authors and other interested hams. There has been lively discussion, but an understanding of why we need a generic protocol seems to be lacking.

The first thing that comes up is questioning the need for AX.25 network changes. Usually, they are along the lines of:

- "We have always done it this way..."
- "Only each individual operator knows where they want their packets to go..."
- "Our local network works just fine for what I want to do..."
- "Adding other layers is too much overhead..."
- "This is Amateur Radio. Everything must be via Amateur Radio..."

These lines of thought are founded in a very myopic view of packet radio normally presented by people who have been using AX.25 networks since the 1980s (I have been using them since then, too). Unfortunately, those views have also relegated AX.25 to a nice toy to play with until you really want to do something constructive.

Let's look at some areas where the rest of the world has gone in data communications while the Amateur Radio community has steadfastly held to the limited, experimental uses of AX.25:

- OSI stack implemented in IP network (Internet).
- Digital cell phone technologies expanded world-wide including data.
- General public given generic local area network access via WiFi.
- Millions of generic local area networks connected together via Layer 3 and above protocols (Internet).
- Wide area wireless Internet access, including via satellite.
- Incorporation of disparate network technologies into global network.

What is common among all of these? They all are pointed towards making world-wide network access simple enough for most people, while keeping the local area networks as lightly loaded as possible. These continue to evolve; AX.25 does not.

If amateurs want their local AX.25 networks, whatever the "flavor," to become usable for activities other than limited experimentation, we need to begin to look upon AX.25 as it was first designed: a Layer 2 protocol.

Today, an amateur must know the topology and purpose of each AX.25 network they want to use. This is fine for limited home-based operations. However, throw in a special event or an emergency and it is time to quit fiddling with the radios and get down to business. Because of the limited nature of our AX.25 networks, this means we move over to voice to get the job done.

Think what could be possible if we moved the "smarts" to work with the AX.25 LAN to software in the same way as Ethernet or 802.11 Layer 2 protocols are used by IP software. To do this, we **must** cease looking at AX.25 as a network protocol and begin to look at it as a Layer 2 protocol.

What does this mean?

- AX.25 must be used as LAN protocol only (direct, one or two repeaters).
- Distance networking must be done at Layer 3 and above.
- A generic "discovery" AX.25 mechanism must be implemented in the repeaters and the network interface software.
- Individual AX.25 protocol adaptations must move to the generic network model and use Layer 3 gateways to achieve distance networking.
- Software developers must create generic protocol stacks for the various common operating systems.

What is gained by adopting a Layer 2 view of AX.25 in our networks?

We gain the ability to use **any** existing AX.25 network for multiple applications. We gain the ability to use **any** AX.25 network without requiring the users to know anything about the network topology. We make AX.25 networks usable for experimentation **and** emergency services, available to local users as well as global travelers.

If we don't adopt the Layer 2 view of AX.25, we risk losing a very viable data communications medium, which has high unrealized potential for special event and emergency services due to difficulty of use. I encourage everyone with an investment in AX.25 equipment to visit the AX.25 Layer 2 SIG at TAPR **(https://lists.tapr.org/cgi-bin/mailman/listinfo/ax25-layer2)** and help bring about the evolution of the protocol.

###

Packet Status Register

#98 Winter 2006, ISSN: 1052-3626

Published by

TAPR
8987-309 East Tanque Verde Road #337
Tucson, AZ 95749-9399 USA
phone 972-671-TAPR (8277)
fax: 972-671-8716
e-mail **tapr@tapr.org**
URL **www.tapr.org**
TAPR Office Hours
Monday – Friday, 9 AM – 5 PM Central Time

Postmaster: Send address changes to TAPR, P. O. Box 852754, Richardson, TX 75085-2754. *Packet Status Register* is published quarterly by TAPR, 8987-309 East Tanque Verde Road #337, Tucson, Arizona 95749-9399 USA. Membership in TAPR, which supports the electronic publication of the *Packet Status Register*, is $20.00 per year payable in US funds.

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of advancing the radio art.

Submission Guidelines

TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you or someone you know is doing something that would interest TAPR, please contact the editor **(wa1lou@tapr.org)** so that your work can be shared with the Amateur Radio community. If you feel uncomfortable or otherwise unable to write an article yourself, please contact the editor for assistance. Preferred format for articles is plain ASCII text (Microsoft Word is acceptable). Preferred graphic formats are PS/EPS/TIFF (diagrams, black and white photographs), or TIFF/JPEG/GIF (color photographs). Please submit graphics at a minimum of 300 DPI.

Production / Distribution:

Packet Status Register is exported as Adobe *Acrobat* version 5 and distributed electronically at **www.tapr.org**

PSR *Packet Status Register* Editor:

Stan Horzepa, WA1LOU
One Glen Avenue, Wolcott, CT 06716-1442 USA
phone 203-879-1348
e-mail **wa1lou@tapr.org**

TAPR is a not-for-profit scientific research and development corporation [Section 501(c)(3) of the US tax code]. Contributions are deductible to the extent allowed by US tax laws. TAPR is chartered in the State of Arizona for the purpose of designing and developing new systems for digital radio communication in the Amateur Radio Service, and for disseminating information required, during, and obtained from such research.

Item	Price	Member Price	Qty	Total	Kit Points
TAPR MEMBERSHIP					
New		$20.00			0
Renewal, Enter Membership Number here:		$20.00			0
KITS					
Bit Regenerator (for regenerative repeater operation)	$10.00	$9.00			1
Clock Option (for regenerative repeater operation)	$5.00	$4.50			1
Compact FlashCard Adapter (FlashCard not included)	$49.00	$39.00			16
DAS (DTMF Accessory Squelch) (as seen in December 1995 QST)	$68.00	$61.20			8
EVM-RI Radio Interface for the Motorola EVM56002	$45.00	$40.00			16
KK7P DSP10 Adapter Kit	$39.00	$39.00			16
KK7P DSPx DSP Module	$99.00	$99.00			16
PIC-E(ncoder)	$65.00	$58.50			16
PK-232 Modem Disconnect (to simplify external modem connection)	$20.00	$18.00			2
PK-232MBX Installation Kit (for 9600-bit/s modem installation)	$20.00	$18.00			2
Reflock-II	$109.00	$99.00			16
T238+MODEM2 APRS Weather Station	$140.00	$126.00			16
TADD-1 RF Distribution Amplifier	$109.00	$99.00			16
X1W-1 Barometric Pressure Sensor	$109.00	$99.00			16
X1W-2 Humidity Sensor	$80.00	$72.00			16
X1W-4 EMP Sensor	$22.00	$19.00			20
FIRMWARE					
TNC2 WA8DED EPROM (ARES/Data standard 8-connection version)	$12.00	$10.80			2
TNC1 WA8DED EPROM	$12.00	$10.80			2
TNC2 KISS EPROM	$12.00	$10.80			2
TNC1 KISS EPROM	$12.00	$10.80			2
PK-87 WA8DED EPROM	$12.00	$10.80			2
TrackBox EPROM	$15.00	$15.00			2
MX-614P Modem IC	$8.00	$8.00			2
TNC2 Version 1.1.9 with KISS EPROM (includes command booklet)	$15.00	$13.50			4
TNC2 Version 1.1.9 command booklet only (firmware is not included)	$8.00	$7.20			2
PUBLICATIONS					
Digital Communications Conference (DCC) Proceedings					
2005 DCC No. 24 (printed copy)	$20.00	$18.00			8
2004 DCC No. 23 (printed copy)	$20.00	$18.00			8
2003 DCC No. 22 (printed copy)	$20.00	$18.00			8
2002 DCC No. 21 (printed copy)	$20.00	$18.00			8
2001 DCC No. 20 (printed copy)	$10.00	$9.00			8
2000 DCC No. 19 (printed copy)	$15.00	$13.50			8
1999 DCC No. 18 (printed copy)	$15.00	$13.50			8
1998-2000 DCC Nos. 17-19 (CD & available printed copies)	$50.00	$45.00			4
1998-2000 DCC Nos. 17-19 (CD only)	$33.00	$30.00			4
1992-1997 DCC Nos. 11-16 (CD & available printed copies)	$33.00	$30.00			4
1981-1991 DCC Nos. 1-10 (CD & available printed copies)	$33.00	$30.00			4
Earlier DCC Proceedings (printed copies):					
Circle desired nos.: 1-4 5 6 7 8	$6.00 ea.	$5.40 ea.			8
Circle desired nos.: 11 12 13 14 15 16 17	$6.00 ea.	$5.40 ea.			8
BBS SYSOP Guide	$9.00	$8.10			8
Packet Radio: What? Why? How?	$12.00	$10.80			8
Packet Status Register Vo. 1 (Nos. 1-17, 1982-85)	$20.00	$18.00			16
Packet Status Register Vo. 2 (Nos. 18-36, 1986-89)	$20.00	$18.00			16
Packet Status Register Vo. 3 (Nos. 37-52, 1990-93)	$20.00	$18.00			16
Packet Status Register Vo. 4 (Nos. 53-68, 1993-97)	$35.00	$31.50			16
TAPR Software Library CD	$20.00	$18.00			4
TAPR Spread Spectrum Update	$18.00	$15.30			16
Wireless Digital Communications	$39.99	$36.00			28
OTHER					
TAPR Badge with Name and Call Sign	$10.00	$10.00			0
TAPR 11-oz. Coffee Mug	$11.00	$10.00			0
GPS EQUIPMENT					
Garmin GA-27 GPS Antenna (w/MCX conn., mag. & suction mounts)	$75.00	$67.50			8
Garmin GDL-47	$80.00	$72.00			28
Garmin GPS18-PC	$94.00	$85.00			16
Garmin GPS-20/25 Data Cable	$15.00	$15.00			2
MCX Right-Angle Connector with Coaxial Pigtail	$15.00	$15.00			2
TAC-32 Software Registration	$55.00	$55.00			0

Order Form

TAPR Business Office
P.O. Box 852754
Richardson, TX 75085-2754
Phone (972) 671-8277
Fax (972) 671-8716
E-mail tapr@tapr.org
Internet www.tapr.org

SUB-TOTAL ☐

SALES TAX (TEXAS RESIDENTS ONLY, 8.25%) ☐

SHIPPING: ☐

TOTAL ORDER AMOUNT ☐

SHIPPING:
1-7 Kit Points = $7
8-15 Kit Points = $8
16-27 Kit Points = $9
28-54 Kit Points = $10
55 or more points, contact TAPR

Name_____ Call Sign_____
Street Address_____
City - State - ZIP Code_____
Country_____ Phone Number_____
E-Mail Address_____

Check Enclosed ☐ or Charge My Credit Card:
VISA ☐ MasterCard ☐ Discover ☐ JCB ☐
Credit Card Account Number_____
Security Code_____ Expiration Date____/____/____
Signature_____