



PACKET

STATUS

REGISTER

**Tucson Amateur Packet Radio Corporation**  
*A Non-Profit Research and Development Corporation*

**Winter 2001  
Issue # 80**

**Published by:**  
Tucson Amateur Packet Radio  
8987-309 E. Tanque Verde Rd.#337  
Tucson, AZ 85749-9399  
Phone: 940-383-0000  
FAX: 940-566-2544  
tapr@lapr.org  
www.tapr.org

**Office Hours:**  
Tuesday - Friday  
9:00am-12:00, 3:00-5:00pm Central

**In This Issue...**

HamHUD has a new home.....	3
Greetings from the Penn-Ohio DX Society .....	3
TAPR Elects Officers .....	4
Electronic PSR? .....	4
Compact Flash Adapter - II.....	5
TUC-52 / METCON-2 .....	6
Modems for AO-40 .....	9
Inside the Kenwood TM-D700 Data Radio .....	10
TAPR Director Roles .....	10
TAPR Appoints New Directors, Secretary .....	11
Director Nominations Sought ..	12
Meeting Minutes 9/22/00 .....	12
Online Meeting Minutes: Quarter 2, 2000 .....	14
Quarter 3, 2000 .....	14
Quarter 4, 2000 .....	17
Proceedings Now Available on CD-ROM .....	18
FHSS Radio Update .....	19
Digital Radio in the New Millenium .....	20
TAPR DCD with MX614 Modem .....	22
TAPR Looking for Volunteers .....	23

**President's Corner - Winter 2000/2001**

The last issue of *PSR* announced that Greg Jones, WD5IVD, has resigned as TAPR President, a position he'd held since 1993. I'm honored to have been selected to follow him. He leaves behind big shoes to fill.

I think TAPR is on the right track. We know what we are focusing on: "enabling technologies" that provide hams with tools to make their own contributions to the art. These technologies range from relatively simple, low cost kits like the PIC-E, which can be programmed to do a multitude of interesting things, to complex cutting edge projects like the FH Spread Spectrum radio, or our new efforts to exploit Software Defined Radios ("SDRs") for ham use. In each case, the end result is not a closed black box, but rather a starting point. Rather than being an end in themselves, these projects provide the basis for further experimentation and development.

The Software Defined Radio concept is a case in point. Elsewhere in this issue, Steve Bible, N7HPR, presents an introduction to SDRs, so I won't repeat his description here. But after reading Steve's article, you will see that SDRs have the potential of moving radio design back into the hands of

**Look for TAPR at these Upcoming Events**

- May 18-20, 2001** Dayton Hamvention
- Sept. 21-23, 2001** ARRL & TAPR Digital Communication Conference Cincinnati, Ohio
- Sept. 22, 2000** Annual Membership Meeting; Cincinnati, Ohio

Packet Status Register  
Tucson Amateur Packet Radio Corp.  
PO Box 51114  
Denton, TX 76206-0114

PERIODICAL  
POSTAGE PAID AT  
DENTON, TX.

RETURN SERVICE REQUESTED

### President's Corner, continued...

lians. Want to try a new mode? With an SDR, you don't have to worry about the hardware, because the radio can be programmed to be whatever you want it to be. Radio design won't depend on the ability to find (and work with) surface mount components, but instead will require only a device that's rapidly becoming the most common tool in the hamshack -- a computer.

Our technical focus is right on, but TAPR does need to make some other changes. Most of those stem from the fact that Greg did far more than provide the organization with leadership; he was a one man band who handled everything from maintaining the web site to being our book editor to monitoring each one of the dozens of TAPR mailing lists. There's simply no way that another president -- at least, not this one -- can handle all those tasks. As a result, I'm going to be looking for a lot of help, both from the other TAPR Board members, and from members who want to volunteer.

One specific change that will be in place by the time you read this column is that I am asking each TAPR Board member to take accountability for a specific role within the organization. For example, there will be a "Membership Director" whose job is to ensure that we are doing the right things to grow our membership. The Director's job won't necessarily be to do all the work himself, but rather to ensure that the work gets done.

This change is important because TAPR can't afford to be a one man show. An old boss of mine used to drive home the point about knowledge sharing by asking the question, "And what happens if you're hit by a bus on the way home from work tonight?" A volunteer organization is even more at risk from change (new job, work pressures, or plain old burnout) than a business, and we need to design an organization that doesn't rely on one person. Although Greg was able to give us enough lead time to make some plans (we even titled a working session last year "Life After Greg"), we may not be so lucky in the future. Spreading the work load will help us be prepared for a bus crash.

I also hope that we'll see volunteers taking on a bigger role in the organization. There are lots of folks out there doing neat technical stuff, but there are also lots of TAPR members who have the ability to help with other roles, even if they're not great with a soldering iron or debugger. If you'd like to help TAPR, we'd like to hear from you.

Finally, one of my other goals is to increase TAPR's membership. I don't think we've done a good job of letting the ham community know what we're all about, and if we spread the word, we should be able to bring more members into the fold. Increased membership provides TAPR not only stronger financial resources, but

Entire contents Copyright © 2001 Tucson Amateur Packet Radio Corp. Unless otherwise indicated, printed permission is granted to reproduce any materials appearing herein for non-commercial Amateur publications provided that credit is given to both the author and TAPR, along with the TAPR glossary number (940-561-8800). Other reproduction is prohibited without written permission from TAPR.

Opinions expressed are those of the author and not necessarily those of TAPR, the Board of Directors, Officers or the Editor. Acceptance of advertising does not constitute endorsement by TAPR. Of the products advertised, APRS is registered to Don Brunsell, W8HAPR. MMT-2 is a trademark of Bob Brimings, W8HAPR.

**Postmaster:** Send address changes to TAPR, P.O. Box 51114, Denton, TX 76206-0114. Packet Class Register (PCRN) 1651 3426, USPS 005-4029 is published quarterly by the Tucson Amateur Packet Radio Corporation, 1418 S. Magness, Denton, TX 76205. Membership in Tucson Amateur Packet Radio, including a subscription to *Packet Status Register*, is \$20.00 per year in the U.S. and possessions, of which \$12.00 is allocated to *Packet Status Register*. Membership is \$20.00 in Canada and Mexico, and \$25.00 elsewhere, payable in U.S. funds. Membership and *Packet Status Register* cannot be separated. Periodical postage paid at Denton, TX.

#### PSR Editor:

Bob Hanson, N2GDE

Internet: psr@tapr.org

#### Advertising:

Contact the TAPR office.

#### TAPR Officers:

<b>President</b>	<b>John Ackermann, N8UR</b>
<b>Vice President</b>	<b>Steve Bible, N7HPR</b>
<b>Secretary</b>	<b>Guy Story, KC5GOI</b>
<b>Treasurer</b>	<b>Jim Neely, WA5LHS</b>

#### TAPR Board of Directors:

Board Member	Term	Internet
John Ackermann, N8UR	2001	n8ur@tapr.org
Dyon Garrabrant, N6BG	2001	n6bg@tapr.org
Doug McKinney, KC3RL	2001	kc3rl@tapr.org
Steve Bible, N7HPR	2002	n7hpr@tapr.org
Bob Hansen, N2GDE	2002	n2gde@tapr.org
Steve Dimeo, K4HG	2002	k4hg@tapr.org
Steve Siroh, N8GNJ	2003	wd51vd@tapr.org
John Koster, W9DDD	2003	w9ddd@tapr.org
Mel Whitten, K0PFX	2003	k0pfx@tapr.org

#### Date is expiration of term on Board of Directors.

The Tucson Amateur Packet Radio Corporation is a non-profit scientific research and development corporation (Section 501(c)(3) of the U.S. tax code). Contributions are deductible in the extent allowed by U.S. tax laws. TAPR is chartered in the State of Arizona for the purpose of designing and developing our system for digital radio communications in the Amateur Radio Service, and for disseminating information required during, and obtained from, such research.

#### Article submission deadlines for upcoming issues:

<b>Spring 2001</b>	<b>March 15, 2001</b>
<b>Summer 2001</b>	<b>June 15, 2001</b>
<b>Fall 2001</b>	<b>September 15, 2001</b>
<b>Winter 2001</b>	<b>December 15, 2001</b>

#### Submission Guidelines:

TAPR is always interested in promoting education and articles for publication. If you have an idea for an article you would like to see, or you'd like someone you know, to bring something that would interest digital communicators, please contact the editors so that your work can be shared with the Amateur community.

The preferred format for articles is plain ASCII text; the preferred graphic formats are HPGL or PCX. However, we can accept many popular word processor and graphic formats. All submissions on diskette should be formatted for MS-DOS.



even more importantly gives us a larger pool of smart folks who can help us advance the state of the art.

## DCC 2000

Orlando gave the 19th ARRL/TAPR Digital Communications Conference a big welcome. Florida is a hotbed of APRS activity, and Friday's APRS symposium showed it, with about 100 people in attendance.

Following the APRS program, the Packet Radio Users Group ("PRUG") of Japan sponsored a reception and provided an update on their activities, which include a demonstration of the possibilities of low cost Internet-connected sensors and software mobile agent technology. PRUG also introduced the TINI-AMeDeS, a Java based one-board computer with Ethernet interface which supports the Dallas Semiconductor I-wire interface, and provided an update on their 2.4Ghz spread spectrum radio, which was shown at the PRUG DCC forum two years ago and has now been commercialized by Root, Inc. We're very glad that PRUG has been able to join us at the DCC for the last four years; their work never fails to impress.

About 135 attended the presentation of technical papers and beginners' sessions on Saturday. The papers included several advanced descriptions of spread spectrum techniques, as well as the (now expected) slew of new ideas from APRS authors Bob Bruninga and the Sproul brothers. Saturday evening's banquet featured Doug Campbell of Triton Networks, Inc. who described the technology his company uses to provide fiber-optic data rates using RF links as high as 90 (!) Gbps.

About 70 people got up early on Sunday morning to attend the PIC development seminar, hopefully, the popularity of this event (which we also did at last year's DCC in Phoenix) will lead to even more cool PIC-based projects showing up.

Geoff Dick, WA4IKQ, who was also the DCC's local volunteer coordinator, won the grand prize drawing on Saturday evening. He walked away with a TM-D700 APRS-capable mobile rig, courtesy of Kenwood.

The next DCC will be held in Cincinnati on September 21-23, 2001. Mark your calendars now!

## Project Update

The good news is that our first run of the T-238 APRS Weather Station kits sold out quickly, and demand for more units is strong. The bad news is that Dallas Semiconductor has dropped the weather sensors (anemometer, etc.) which are kind of important to putting the kit to use. Rumors abound of an alternative source for the sensors, and we're standing by to see if they become available again. If they do, we'll put together

another run of the kits. Until then, we're only taking "hold your place in line" orders for the T-238.

The FH55 radio project continues to move along slowly. The redesign that was forced by the discontinuation of many critical parts has really moved us backwards; the team is now debugging problems on the new design that didn't cause us to bat an eye on the old boards. But progress is being made, even if it's slow going.

## Packet Status Register - An Electronic Future?

Elsewhere in this issue of PSR you'll find a survey asking your views about whether we should continue to publish PSR in paper form. We'd really appreciate your input; we know that receiving PSR is an important part of TAPR membership, but we also know that the paper version consumes resources that could be used to provide other services. Please let us know what you think!

## Thanks!

The DCC ended up being really successful, although there were a few nervous moments along the way. I'd like to thank our coordinators, Steve (N8GNJ) and Tina Such, and local volunteer leader Geoff Dick, WA4IKQ, for their hard work and perseverance. It really paid off. Local volunteers Aaron Morrison, AE4KO, and Keith Koteln, KF4BXT, also did a lot of hard work behind the scenes to help make the show succeed.

Thanks to them as well.

73 for now,  
John

---

## HamHUD has a new home: hamhud.net

Steve Urigo, KA9MVA  
Lu9mva@aol.net

The HamHUD project (a minimalist APRS(tm) mobile terminal with SmartBeaconing) has a new website:

<http://www.hamhud.net> Top level  
<http://hh2.hamhud.net> HamHUD II (current)  
<http://hh3.hamhud.net> HamHUD III (in design)

---

## Greetings from the Penn-Ohio DX Society (PODXS)

Jay, N3DQU

Greetings from the Penn-Ohio DX Society (PODXS). Please pass the word to the PSKers in your group about our free 7 Club PSK award program. Info about the 7 Club can be found at our website:

<http://hometown.aol.com/n3dqu/podxs.htm>

## TAPR Elects Officers at 19th Annual Digital Communications Conference

John Ackermann, N8UR, was elected the new president of TAPR at the 19th ARRL/TAPR Digital Communications Conference held in Orlando September 21-24, 2000.

135 hams, including a dozen from outside the US, attended the annual event, which includes presentation of technical papers, hands-on demonstrations, and beginner's sessions. Over 100 people attended Friday afternoon's APRS seminar, and 70 were present for a technical symposium on programming PIC chips held Sunday morning.

Ackermann succeeds Greg Jones, WD5YD, who had served as president since 1993, with Steve Bible, N7HPR, replacing Ackermann as vice president. Bob Hansen, N2GDE, will continue to serve as secretary, and Jim Neely, WA5LHS, remains treasurer. The elections were held at TAPR's annual board meeting, held in conjunction with the DCC.

"Greg Jones led TAPR through a period of growth and innovation," Ackermann said. "On his watch, we brought significant new products to market, including the DSP-93 digital signal processing unit, Totally Accurate Clock, and Mic-E and Pic-E data encoders. Greg also laid the groundwork for our Frequency Hopping Spread Spectrum Radio project. He guided us into the Internet age, along the way creating the TAPR SIG mailing lists that now handle thousands of messages per month. Greg is also responsible for our increased publishing activities. His retirement leaves a void in TAPR that will be hard to fill."

Ackermann said that his primary objective will be to ensure that TAPR remains on the cutting edge of radio technology, with a special emphasis on emerging concepts such as Software Defined Radios. He will also focus on increasing membership and optimizing the organization's management structure.

Ackermann (ex-AG9V), who lives in Dayton, Ohio, has served on the TAPR Board of Directors and as vice president since 1995. He was first licensed in 1974 and has helped build packet radio networks in Ohio and Wisconsin. Ackermann is active on APRS, runs a Linux-based Internet site at his home, and can occasionally be found on CW chasing DX.

Bible lives in Kingsland, Georgia, and has been a TAPR Board member since 1996. He was project manager for TAPR's Totally Accurate Clock (TAC-2), EVM Radio Interface, PIC Encoder, and DGPS Reference Station kits. Bible is leading TAPR's development of a road map to develop Software Defined Radio technology for amateur use.

In other news from the DCC:

- TAPR announced that it will be offering the "EasyTrak" satellite rotor and radio controller. This PIC-based unit will control azimuth and elevation rotors for satellite use, as well as nine popular radios for Doppler correction.
- PRUG, the Packet Radio Users Group of Japan, demonstrated the possibilities of low cost Internet-connected sensors and software mobile agent technology. PRUG also introduced the FINI-AMEDES, a Java based one-board computer with Ethernet interface which supports the Dallas Semiconductor I-wire interface, and provided an update on their 2.4Ghz spread spectrum radio, which has been commercialized by Root, Inc.
- Geoffrey Dick, W44KC, was winner of the grand prize awarded at the Saturday evening banquet. Geoff won a TM-D700 APRS-capable mobile radio donated by Kenwood.

DCC 2001 will be held in Cincinnati, Ohio from September 21-23, 2001. Conference coordinators will be Steve and Sheila Bible assisted by local coordinator Hank Groeb, N8XX.

## Should the Packet Status Register Move to Electronic Format?

We know from your comments that receiving the *PSR* is an important benefit of being a TAPR member. However, you may not be aware that printing and mailing the *PSR* is one of the biggest expenses we incur. The labor required to handle each issue is also a significant effort. The TAPR Board has been considering for some time whether we should move the *PSR* to an electronic format. In addition to reducing our costs, an electronic *PSR* could be more timely and could take advantage of multimedia -- for example, we could print color photos, include audio or video clips, and even include software on occasion. Now, we'd like to hear from you. Please let us know -- by email to [tapr@tapr.org](mailto:tapr@tapr.org), comments on the [tapr](http://tapr.org) web site, or even plain old mail mail -- what direction you'd like *PSR* to go:

1. Continue with a paper *PSR*. (If this is your choice, please let us know -- honestly -- whether moving to an electronic-only publication would cause you to drop your TAPR membership.)
2. Drop the paper version and make the *PSR* available through a "members only" page of the [tapr](http://tapr.org) web site. (If this is your choice, please let us know whether you'd want an email notification that a new issue is available.)
3. Send the *PSR* content via email (probably a PDF file with links to other resources embedded).

Your input will help us make the right decision.

## Compact Flash Adapter - II

### Summary

TAPR is pleased to announce a new and improved version of the Compact Flash Adapter card. The -II version accepts Type II Compact Flash cards. This will allow the use of the IBM Microdrive and supports the use of DMA with the Microdrive. Also new with the -II version is the option of a user supplied and installed 2.5" inch IDE (44 pin 2mm pitch) connector.

Price \$59, available once the current supply of Type-I adapters is exhausted.

### History - Type I Adapter

About two years ago a CompactFlash (Type I) Adapter was developed to fill a need for a rugged boot disk for equipment located in harsh environments. It is a passive device that simply maps the signals from the 50 pin CompactFlash connector to the 40 pin IDE connector and a pin power connector. Approximately 400 of these have been sold.

### Why a Type II Adapter?

Shortly after the first few original adapters were sold, we started getting emails with suggestions on how to improve the product or "why didn't you do it this way"? As valid as all the comments were, none were compelling enough to trigger a new version, until this question: "Will it work with the IBM Microdrive?" Some of these questions were coming from within IBM. Well, we had to brush up on the changing CFA specification. We did a layout of a new board incorporating the changes needed for Type II cards and hopefully including all the suggestions made earlier. The Type II adapter has been tested with an IBM Microdrive in an IBM facility and is on their IBM Microdrive Compatibility Matrix.

### General Information

#### Size:

2.6" x 3.065" x 0.5" (66mm x 77.8mm x 12.7mm)

#### Mounting hole size and pattern:

0.14" (3.56mm) diameter on a 2.3" x 2.6" (58.4mm x 66mm) pattern

#### Power requirements:

Voltage: +5 VDC via 3.5" floppy style power connector or the 44 conductor "2.5 in." IDE cable.

Current: None for the adapter, total depends on card inserted.

#### IDE Interface:

40 pin 0.1" pitch IDE connector, optionally the purchaser may install a 44 pin 2mm pitch "laptop" IDE connector.

#### CF socket:

Type II socket with guides, no ejection button.

### Mini FAQ

#### What is it?

A small circuit board which has a socket to accept a Compact Flash memory card. It also has an IDE drive connector and power connector.

#### What does it do?

It allows one to build a diskless PC system. The Compact Flash card provides 100% hard drive emulation.

#### How do I use it?

You plug in power and IDE cables from your PC and plug in a Compact Flash card. Initialize the Compact Flash card and install the operating system just as you would on a regular hard drive.

#### What operating systems may I use?

Both Linux and DOS 6.22 have been tested. The only theoretical limitation is the Compact Flash card capacity. (e.g. Windows 95 wouldn't fit on an 8Mb Compact Flash card.) However, now that you can use an IBM Microdrive, that shouldn't be a problem.

#### Where do you get the CompactFlash card?

At any store that carries digital cameras or digital camera accessories.

### Using the Adapter

The flash adapter board is supplied assembled. To use the adapter, you need the following:

- A CompactFlash card (size depends on the operating system and applications to be loaded)
- A spare connector on your IDE ribbon cable
- An unused power connector compatible with the common 3.5" floppy drive
- A place to mount the card

Reference material for the Compact Flash specification is available at the CompactFlash Association ([www.compactflash.org](http://www.compactflash.org)) web site. Reference information for the IBM Microdrive is available at the IBM Microdrive Developer's Corner ([www.storage.ibm.com](http://www.storage.ibm.com)).

CompactFlash is a trademark of the CompactFlash Association.

Microdrive is a trademark of IBM.

## TUC-52 / METCON-2

TAPR announces the release of the TUC-52 kit which is an 80C32-based controller. Features of the TUC-52 include the following:

- Real Time Clock
- EPR0M based Basic
- 32 kb SRAM
- 32 kb EPROM
- 2 85C55 parallel I/O chips
- 2 serial ports (TTL levels)

Price \$139

### Metcon-2

TAPR also announces the release of the Metcon-2 option for the TUC52.

The Metcon-2 board provides:

- Power control relay
- Signal conditioning for 8 digital inputs.
- RS232 level converters for 2 serial ports
- RS485 level converter

The Metcon-2 connects to the TUC-52 via a 50 conductor ribbon cable.

Price \$105

### Options for Metcon-2/TUC-52

MULRLY board provides 8 isolated relay (SPDT) contact outputs.

Price \$79

Metcon-1 options may also be used with Metcon-2.

See the article elsewhere in this issue for more information about the TUC-52 and the Metcon-2.

## TUC-52 and MetCon-2

*[This article was compiled from web pages authored by Paul Newland, ad71; additional material and editing by John Koster, w9idd]*

Several years ago TAPR introduced METCON, a telemetry and control system. Unfortunately, that system is no longer available for new applications. The METCON-2 system is a replacement for and an improvement to the original METCON system.

The METCON-2 system is functionally similar to the original METCON system, however there are some differences. First, instead of using a single IC 8751 as the microcomputer system, the METCON-2 uses the new TAPR Universal Controller 8052 (TUC-52). This is a

small single board computer that is capable of running BASIC with a rudimentary file system (as well as assembly coded application programs). The TUC-52 is described below:

The METCON-2 system consists of several boards, some of which are optional. In its most basic form, METCON-2 consists of a TUC-52 controller board and a METCON-2PB personality board. These two boards recreate the original METCON functionality, which is 8 bits of binary over-voltage-protected inputs, frequency counter for each of the binary inputs, and 8 bits of control output. Additionally, the METCON-2 will provide the ability to program the system in BASIC for advanced control and measurement functions.

One item missing from METCON-2 is the isolated form A (SPST) relay contacts. To save money and space METCON-2 provides open collector current sink outputs instead of dry relay contacts. However, for those applications that require dry relay contacts, a new multiple relay module, the MULRLY board, has been designed. This module is designed to connect directly to the METCON-2PB personality board and provide 8 relays with form C (SPDT) dry contact outputs. An additional change provided by METCON-2 versus the original METCON, as requested by many users, is that all connections to the outside world are by means of screw terminals rather than the lever wire-compression terminals. This should improve interconnections in those environments where vibration is a problem.

METCON-2 is fully compatible with the original METCON ADC (analog to digital converter) module, the VTF (Voltage/Temperature to Frequency converter) module and the ETP (Elapsed Time Pulser) Module.

The minimum METCON-2 system consists of the TUC-52 (TAPR Universal Controller) and the METCON-2PB (METCON-2 Personality Board). To the minimum system you may add additional modules or boards such as the ADC, VTF, ETP and MULRLY. Each of these will be described briefly.

### METCON-2PB

The METCON-2PB is a 4.5" by 6" circuit board that contains the circuitry needed to make the TUC-52 a complete METCON-2 system. The board is easily added to the TUC-52 by means of a 50 conductor ribbon cable connected between 50 pin headers on each board. The functions provided by the METCON-2PB are: Power conditioning and control, 8 inputs with signal conditioning, schmitt trigger (74HC14) and 8 input multiplexer, 2 MAX232 line driver/receiver interfaces, a RS485 transceiver, a simple two wire serial bus interface, and a watch dog timer.

## TUC-52 Description

### Introduction

This board serves as a universal controller based on the 8051/8052 architecture. The constraints are to have a board that is capable of operating with internal masked rom or external EPROM, and that the memory map provide both Harvard (separate code and data) or Von Neuman (combined code and data) addressing modes. RAM sites are provided such that up to 64K of RAM can be addressed on the board and both RAM sites may be battery backed up. There are several pre-programmed memory maps that the user can choose by placing shunts on shorting blocks. One particular memory map will allow the operation of INTEL's MCS BASIC-52, a stand alone "tiny basic" system that includes floating point calculations and a rudimentary file system for storing and retrieving basic programs as well as the ability to begin executing a user developed preprogrammed basic program at reset, without any operator intervention.

Plenty of bit I/O has been provided for so that bus signals do not need to leave the board. However, provision is made for a limited bus to be conveyed to another close-by board.

### CPU and Associated Glue

IC1 is the CPU socket that holds most any member of the 8052 family that uses a 40 pin DIP package, including the Dallas DS80C320. IC1 typically is stuffed with an 80C32 (the rom-less version of the 80C52). Y1 provides a standard clock frequency of 11.0592 MHz that allows for common baud rates on the serial UART port.

Serial communications with the CPU via an on-board "poor man's" RS-232 interface or an off-board RS232 line driver/receiver such as provided by the METCON-2PB.

The CPU may execute code from it's internal masked program memory or from an external EPROM. The choice is determined by the positioning of a shunt.

Many different memory installations are possible with TUC52. At the bare minimum (and we really never expected to operate this way) it's possible that TUC52 could operate with only internal code and data within the 8051/8052, leaving IC4, IC5 and IC6 unpopulated. More likely is that IC4 will contain an EPROM with code and that the 256 bytes of RAM internal to an 8032 will be used for read/write storage. Most simple applications can run in this mode.

Moving up the scale of complexity, the next embellishment would be to have a RAM device at IC6. In this configuration IC4 could be mapped for code space from 0H to 7FFFH while IC6 could be mapped for code AND data from 8000H to EFFFH.

When TUC52 is used for MCS BASIC-52 program development a RAM device would be added at IC5 which would be configured for data space from 0 to 7FFFH. In this case IC5 serves as working program memory while IC6 serves as the file system for storing programs and data. When TUC52 is used as a stand-alone mountain-top MCS BASIC-52 program execution system, IC6 will hold a ROM that contains the user's BASIC source code program. A ROM is used in this case instead of BBRAM because it's more reliable.

### I/O

There are two main types of I/O for TUC-52: processor I/O and memory mapped auxiliary I/O. Processor I/O is I/O provided by the processor IC itself while auxiliary I/O is that provided by memory mapped 82c55 parallel ports. First consider processor I/O.

There are two processor I/O ports available: P1 and P3 of 8 bits each. The P1 port usually provides general purpose bit I/O while P3 has special features associated with each lead. However, the special features of P3 can always be disabled and the ports used for simple bit input/output I/O. For advanced processors (like the Dallas DS80C320) even the P1 port has special features associated with it.

The features of P3 are always as follows (in addition to general purpose bit I/O):

P3.0	RXD	UART Data Input
P3.1	TXD	UART Data Output
P3.2	INT0*	Interrupt 0 Input
P3.3	INT1*	Interrupt 1 Input
P3.4	T0	Timer 0 Input
P3.5	T1	Timer 1 Input
P3.6	WR*	Bus Write (not available for bit I/O)
P3.7	RD*	Bus Read (not available for bit I/O)

For 80C31 devices port P1 provides only bit I/O, without special features. For 80C32 devices port P1 can provide the following special features (in addition to general purpose bit I/O):

P1.0	T2	Timer 2, External Count Input
P1.1	T2EX	Timer 2, Capture/Reload Trigger Input

Some Philips parts also allow each of the P1 ports to serve as an independent interrupt signal.

For the Dallas DS80C320 device, port P1 can also provide the following special features (in addition to general purpose bit I/O):

P1.0	T2	Timer 2, External Count Input
P1.1	T2EX	Timer 2, Capture/Reload Trigger Input
P1.2	RXDX	Second UART Data Input
P1.3	TXDX	Second UART Data Output
P1.4	INT2	Active high interrupt

- PI.5 INT3\* Active low interrupt
- PI.6 INT4 Active high interrupt
- PI.7 INT5\* Active low interrupt

Auxiliary I/O is that provided by up to two 82c55 parallel ports. The first 82c55 is IC13 which has non-inverting high voltage open collector drivers connected to port A. These drivers can easily be omitted by simply replacing the driver IC with a "straight across" jumper block. Pull-up resistors, formed by RS3, are provided for port B. These too can be omitted for applications that don't need them (or don't want them). Ports A, B and C of IC13 are brought out to the PORT BLOCK for connection to another board for specific interfacing requirements.

The second 82c55 (IC15) ports are connected directly to the BUS BLOCK without any other embellishments.

#### Connector Blocks

There are three major connector blocks: the PORT BLOCK, BUS BLOCK and POWER BLOCK. There is one minor block: the AUX BLOCK.

The PORT BLOCK is the block that's expected to be used in almost all applications. The PORT BLOCK is a 50 pin header (.025" pins in a 2x25 array on 0.1" centers). The PORT BLOCK conveys nets for P1 and P3 from the processor as well as the three ports from the primary 82c55 (A=P4, B=P5 and C=P6). Essential power and control signals also pass through the PORT BLOCK. The an area for concern is the voltage drop on the GND, -5 and +V nets through the PORT BLOCK interconnections. If this drop is considered to be excessive then the POWER BLOCK should be used as well.

The BUS BLOCK is not expected to be used often but it is available for those applications that need its circuits. The BUS BLOCK is a 34 pin header (.025" pins in a 2x17 array on 0.1" centers). The BUS BLOCK conveys nets for the three ports from the secondary 82c55 (A=P7, B=P8 and C=P9) as well as the data bus (Dn), the low nibble of the address bus (An), the I/O chip-selects, WRITE, READ and RESET as well as additional GROUND connections.

The POWER BLOCK is used to provide a low voltage drop connection between TUC-52, any interface board(s) and the external power source. The POWER BLOCK is a 4 screw terminal strip. This block would not always need to be used since its circuits are redundant with those provided by the PORT BLOCK for most applications. One reason for the user to make use of the POWER BLOCK is if the TUC52 is being used standalone. Another reason would be if there is an excessive voltage drop in the -5 and/or ground nets through the PORT BLOCK for example because of the ribbon cable length used.

The AUX BLOCK is optional and not expected to be used often but it is available for those applications that need its circuits. The AUX BLOCK is a subset of the PORT BLOCK and serves as a low cost alternative for applications that don't need the 50 pin connector and cable of the PORT BLOCK. The AUX BLOCK is a 20 pin header (.025" pins in a 2x10 array on 0.1" centers).

#### Power Control and Reset

Unregulated power is applied to the +V net either from the interface board through the PORT BLOCK or through the POWER BLOCK. This voltage is regulated to +5 volts by VR1. Option block H18 is provided so that the regulator can be isolated from the -5 net for those cases when the -5 net is back-fed from the interface board or in standalone situations from the POWER BLOCK.

A power monitoring circuit determines when to disable the BBRAM (Battery Backed Random Access Memory) to preserve it's contents. It also provides the CPU reset signal. The CPU reset signal can also be triggered by a break condition on the received data line if desired. A small flat nickel sized 3-volt battery provides the back up supply for the BBRAM.

#### Clock and Non-Volatile Memory

A PCF8583 provides a simple time of day clock and 240 bytes of BBRAM while a PCF8582 provides for data retention by an EEPROM. Both devices communicate with the CPU by means of the Philips I2C protocol.

#### Minimal Serial I/O

A 75HC14 provide a "poor man's" RS-232 interface. It's not expected that this interface will take the place of a real RS-232 interface (which is on the METCON-2PB). The "poor" interface is included for simple systems that don't make use of an interface board such as the METCON-2PB. Not to advance this interface as a desirable alternative to a MAX232 interface, but I've used this "poor" interface on many systems over the years and have yet to find an RS-232 device (manufactured after 1980) that it won't work with over short runs (less than 20 feet).

#### Optional Modules and Boards

##### ADC - Analog to Digital Converter Module

The ADC (Analog to Digital Converter) module is connected to METCON through a short seven conductor ribbon cable. The firmware within METCON polls the ADC module through this cable to read the values at the inputs to the ADC0838 (IC1), the Analog to Digital Converter integrated circuit.

This module measures up to eight external differential voltages in the range of either 0.00 to +2.55 volts or -1.27



to  $\pm 1.27$  volts by means of a balanced input circuit of about 100K ohms. The common mode input range extends from at least -1.00 to  $\pm 2.50$  volts.

### VTF - Voltage (and Temperature) To Frequency Converter

The Voltage To Frequency Converter for use with the METCON telemetry and control system measures an external positive voltage and then frequency modulates an external circuit for remote monitoring. It may also include an optional temperature sensor.

A good question would be "if you want to measure voltage why convert it to frequency?" One advantage of VTF is that the signal to be measured can be converted to a frequency right at the source. The audio frequency signal (0 to 10 KHz) can then be transmitted over wires (or radio for that matter) to the monitoring unit where the frequency of the audio signal is measured and stored in memory for remote access. Additionally, the signal can be passed through a simple opto-isolator to provide a large voltage isolation capability between the signal source and the monitoring unit. The audio signal can be transmitted over telephone house wires as a 5 volt peak-to-peak digital signal. There could be up to 0.5 VAC rms of 60 Hz hum on this line but the "digital" audio frequency signal will still be received with the correct frequency. Also, it's unlikely that external noise induced into the wires would convert a 2360 Hz signal to 2130 Hz. However, the analogous situation for Analog-to-Digital Conversion doesn't fair so well. What might be the chance of transmitting a 0.236 VDC signal down a 500 foot run of telephone wire and having a digital voltmeter at the other end reading 0.236 volts? Probably not good, especially when the air conditioner compressor motor starts up, or the refrigerator starts up, or... well you get the idea. The down-side of VTF is that each update take some time to acquire (one second for each channel in the case of METCON).

### ETP - Elapsed Time Pulser Module

The Elapsed Time Pulser (ETP) module provides a 100 mS pulse output once every N seconds that the input is active, where N can take on integer values from 1 to 498. This module, when connected to a METCON input that is configured as a totalizing pulse counter, provides an elapsed time indicator in units of seconds or minutes.

### MULRLY - Multiple Relay Board

The Multiple Relay board (MULRLY) contains 8 relays with 5VDC coils and 1 form C (SPDT) contact each. The contacts are rated at 0.50 A at 125 VAC or 1 A at 24 VDC and they are available at a screw type terminal block. The relay coils appear at another terminal block and are paralleled by 1N4148 diodes. This board is fairly universal and could be used in other applications.

### Summary

To summarize, the METCON-2 is a family of boards and modules that may be used in a variety of monitoring and control applications. The TUC-52 and METCON-2PB form the core of the system to which you may add the ADC, VTF, ETP or MULRLY.

### Modems for AO-40

*[The following information is from TAPR's DSP-SIG. It describes various methods of decoding telemetry from Oscar 40 (Phase 3D satellite).]*

### DSP-12 - a good P3D 400 baud TLM receive modem

Bert Baggett, OZ6BI.  
oz6bi@umaut.org

I have updated a modified version of the 400 baud PSK modem for the DSP-12 to the following URL:

<ftp://ftp.tapr.org/dsp/Matricula/dsp56001/dsp-12>

The modification consists of a change to the software so that it sends 514 bytes rather than 512 to the listening program. Also the CRC bytes will get transmitted to the listening program.

The modified modem has been tested by Stacey Mills, W4SM, and he has this to say about the modem:

I burned the neweproms and checked out the 400 baud PSK demodulator with 514 byte capacity. It works very well... Actually, very, very well. In fact, doing some tests with some 400 baud PSK wave files that I have generated, having a calibrated background noise, the DSP-12 functioned as well or better than any other modem I have tested.

The file [gce201.zip](#) contains these files:

README  
GCE.V40 - Executable that may be downloaded to the DSP-12  
GCE.B - PROM image for the B-PROM. Checksum: 51900  
GCE.D - PROM image for the D-PROM. Checksum: 55000  
GCE.F - PROM image for the F-PROM. Checksum: 54900

Have fun

### P3D 9600 downlink modem for EVM

Douglas Homan, NA1DR  
doagnad@bellatlantic.net

At [www.doughbraun.com](http://www.doughbraun.com) you will find a link to a P3D telemetry decoder modem for the EVM. The file name is "p3d.asm"

The modem has a couple of options for generating a test output signal. It can "transmit" data it gets from the serial port, or it can repeatedly send a canned message. You can either connect the EVM's output and input jacks

together, or you can record the output signal and play it back later.

If you have successfully used the `g3ruh.asm` modem on your system, you should not have any trouble figuring out how this one works.

### P3D Telemetry on Sound Card

nils.schiffhauer, DK8OK  
nils.schiffhauer@micronet.de

Telemetry from AO-40 has been successfully decoded using just a soundcard and the WPSKDEC program, available from [www.amsat-france.org](http://www.amsat-france.org). Follow these steps:

- fill out a short registration form
- download the software
- explode the zipped file into a folder
- tune into 145.898 kHz when the bird sings
- tune your radio (even a scanner will lead to results) so that the center frequency of the BPSK signals reads in the range of 1.200 Hz to 1.600 Hz (SPECTROGRAM is a great help to do this precisely with PC/soundcard, look at: [www.monumental.com/rshorne/gram.html](http://www.monumental.com/rshorne/gram.html))
- make a sound clipping (8.000 Hz sampling, 8 bit resolution) as a wav-file; name it "P3D.WAV", it will overwrite the test file having the same name
- start (doubleclick) the program `PSKDEM.EXE`
- the DOS window will start prompting for the center frequency in Hz
- hit RETURN, and the demodulation will start instantly, writing the text automatically into BIN-File "P3D.BIN"
- after demodulation, close this window and start (doubleclick) file `TLMDEC.EXE` to automatically convert the BIN-file into easy-to-read telemetry text

Although sounding a bit complicated, it seems to be fool-proof for it worked just at the very first attempt on my PC. With nothing more than a handheld scanner and a laptop it's great to demonstrate amateur radio's state-of-the-art. The guys from AMSAT-France are working on a Windows & Linux version - keep tuned.

The WPSKDEC software is available at:

[www.ccr.jussieu.fr/physio/amsat-france/index.htm](http://www.ccr.jussieu.fr/physio/amsat-france/index.htm)

or

[rackoon.thomson-csf.fr/amsatf.htm](http://rackoon.thomson-csf.fr/amsatf.htm)

### P3D Soundcard Decoder

Nino Porcino, IZ8BLY  
porcino@sysonline.it

I've released a soundcard-based decoder for the P3D (AO-40) satellite telemetry. It runs under Win9X and is available at:

<http://iz8bly.sysonline.it>

### Soundcard Software P3D Telemetry Decoder

Thomas Sailer  
sailer@ife.ee.ethz.ch

Here's my version of a soundcard software P3D demodulator. It is open source, multiplatform (Linux, Sparc Solaris, Win32 with DirectX), uses MMX if available, and requires no tuning (the center frequency can be anywhere between 1.2kHz and 2kHz).

<http://www.ife.ee.ethz.ch/~sailer/ham/p3d/>

---

### Inside the Kenwood TM-D700 Data Radio

Stephen H. Smith, WA8LMI  
WASLMI@aol.com

If you have ever wondered how Kenwood crams all that functionality into the TM-D700, here's your chance to see what's inside the box. I took mine apart, shot some closeup pictures, and put them up on my website.

<http://members.aol.com/wa8imf/ham/index.htm#TMD700pics>

I was astounded to see that the entire radio is built on a single PCB combining the analog RF, audio, digital and synthesizer blocks. There is no segregation of analog and digital into separate modules or shield cans like any other radio I have seen.

---

### TAPR Director Roles

To help better manage TAPR, the Board members have agreed to each take on responsibility for one aspect of the organization's operations. We expect that these roles and responsibilities will change as we gain experience, but here are the current assignments:

#### Manufacturing Director: John Koster, W9DDD

The Manufacturing Director has responsibility for production of TAPR kits. He works closely with the Project Director to ensure that kits are designed for manufacturability and lowest cost, and is TAPR's point

of contact with IC board manufacturers, metal fabricators, etc. The Manufacturing Director oversees the volunteer(s) who do TAPR's kiting.

**Marketing Director: Doug McKinney, KC3RL**

TAPR needs to keep its name, and its projects, in front of the ham community. The Marketing Director is responsible for ensuring that we get news releases, interviews, and articles published in the ham press. The Board will establish goals for the number of article and press release placements per year, and the Marketing Director will be responsible to meet them. The Marketing Director will also be in charge of TAPR advertising, and will work with the Membership Director to attract and retain new members.

**Membership Director: Steve Blimse, K4HG**

The Membership Director is primarily responsible for growing our membership to the goal that the Board sets. He will work closely with the Marketing Director to accomplish this. The Membership Director should also monitor the "pulse" of the membership and, together with the President, serves as a liaison to the Board for member issues.

**Newsletter Director: Bob Hansen, N2GDF**

The Newsletter Director is responsible for the editorial content and production of TAPR's quarterly newsletter, the *Packet Status Register*.

**Project Director: Steve Bible, N7HPR**

The Project Director has overall responsibility for the development of TAPR kits and other hardware-oriented projects. He supports the Project Managers assigned to each project, and works with the Manufacturing Director to ensure that kits can be produced economically.

**SIG Director: Open**

The SIG Director has responsibility for TAPR mailing lists and is the contact point for the various list administrators. He keeps tabs on the TAPR online community.

**Web Director: Open**

The Web Director is responsible for TAPR's online presence. He manages the TAPR webmaster and is the primary liaison with TAPR's system administrator.

**Publications Director: Open (temporarily, Greg Jones WD5IVD assisting)**

The Publications Director is responsible for the development, production, and (in conjunction with the Marketing Director) marketing of TAPR books and software products other than the *PSR*.

## TAPR Appoints New Directors, Secretary

Steve Stroh, N8GNJ, and Byron Garabrant, N6BO, have been appointed to the TAPR Board of Directors, and Guy Story, KC5GQI, has been appointed the organization's Secretary.

Steve Stroh is a long time member of TAPR. He lives in Woodinville, Washington, a suburb of Seattle, where he is a member of the Puget Sound Amateur Radio TCP/IP Group (also known as WestNET, the Washington Experimenter's TCP/IP Group) and MicroHAMs, the Microsoft Amateur Radio Club. Steve's major interests in Amateur Radio are digital modes and advanced wireless networking. Steve has been the manager of TAPR's "NetSig" special interest group for several years, and has also been active in TAPR's spread spectrum SIG.

Steve was recently named Digital Editor for CQ Amateur Radio Magazine and writes CQ's monthly Digital Wireless column. Professionally, he is a full-time Independent Technology Writer, focusing on Broadband Wireless Internet Access.

Steve will fill the remaining Board term of Greg Jones, WD5IVD, who previously announced his desire to resign from his TAPR offices after many years of service.

Byron Garabrant has been active in packet radio and transmitter hunting since he was licensed in 1990. He served as the Digital Communications Officer for Orange County RACES for 5 years, maintaining the group's packet DBS, and organizing digital communication exercises using packet message-passing software he created.

In 1998, Byron began actively working with TAPR as a member of the PIC-E design team, and published the firmware used in the PIC-E. He has also given presentations at the last three Digital Communication Conferences on PIC programming. Byron has created several PIC-based amateur radio devices, including the GST-1 and GST-2, which allow GPSs to be used with APRS, the TinyTrak, an inexpensive TNC replacement for an APRS tracker, and PicCon, a transmitter controller for T-Hunting. He sells these devices as kits from his home business, Byonics. He lives in Las Vegas, Nevada, with his wife, Lara, KD6AYO, and three children and works as a computer game programmer for Westwood Studios.

Byron will fill the remaining Board term of Barry McLarnon, VE3JF, who served TAPR as a Director and volunteer for many years. TAPR will miss Barry's technical knowledge and true ham spirit.

Guy Story was first licensed in 1994 and has been an active packet radio user since his first day as a ham. He operated a TCP/IP station using JNOS before becoming

active in APRS in early 1997, when he also joined TAPR. As a TAPR member, he has been actively involved in the organization's APRS and spread spectrum activities. Guy is also the APRS Chairman and repeater control operator for the Denton County Amateur Radio Association and is an assistant emergency coordinator for Denton County ARES.

Guy lives in Denton, Texas and is an Electronics Technician in the area of EMC/EMI compliance for Interphase Corporation in Dallas.

Guy takes over as Secretary from Bob Hansen, N2GDE, who continues as a Director and as Editor of the Packet Status Register, TAPR's quarterly journal.

## Nominations Sought for TAPR Board of Directors

Tucson Amateur Packet Radio is incorporated in the State of Arizona as a non-profit scientific and educational institution. It is recognized by the IRS as a 501(c)3 tax-exempt organization for these same purposes. TAPR is governed by a 9-member Board of Directors. Each member of the Board serves a three year term. Every year three positions are up for election.

Board members are expected to attend two board meetings each year held in conjunction with the Dayton Hamvention and the ARRL and TAPR Digital Communications Conference. They participate in the decision making process and provide guidance to the officers. They receive no pay and must defray most of their own expenses to attend meetings. Board members should be prepared to be active in the continuing Board deliberations, which are conducted via a private mailing list on the Internet. Active participation in TAPR activities by Board members is important to the furtherance of the objectives of TAPR. The officers of TAPR are elected by the members of the Board at the annual Board of Directors meeting.

The current members of the Board of Directors and the expiration dates of their terms are:

* John Ackermann, N8UR	2001	President
* Doug McKinney, KC3RL	2001	
* Byron Garabrant, N6BG	2001	
Steve Bible, N7HPR	2002	Vice President
Steve Dimse, K4HG	2002	
Bob Hansen, N2GDE	2002	PSR Editor
Steve Stroh, N6GNJ	2003	
John Koster, W9DDD	2003	
Mal Whitten, K0PFX	2003	

Nominations are now open for seats expiring in 2001 (marked with an asterisk).

To place a person in nomination, please remember that he or she must be a member of TAPR. Confirm that the individual is willing to have their name placed in

nomination. Send that person's name (or your own if you wish to nominate yourself) along with your call and their call, telephone numbers, mailing address, and Internet address. The person nominated should submit a short biographical sketch to be published along with the ballot.

Nominations and biographical sketches should be submitted to the TAPR office no later than April 15, 2001.

Responsibilities of a board member include:

- 1) Attendance at both board meetings each year.
- 2) Regular participation with the continuous session of the board (currently held over the Internet). Typically this requires a minimum of 3 hours a week, although sometimes much more is required during active board discussions.
- 3) Participation with TAPR projects as volunteered. Board members, while not required, are involved with various project management, ongoing organization and/or supervision/liaison positions. Active board participation with various projects make many of the most important projects and tasks possible. Board members are expected to take an active part in TAPR in some form.

All nominated members will be placed on the ballot and the highest vote receivers will be placed in the open board positions. All directors shall serve for a term of three years.

## TAPR Board of Directors Meeting Minutes 9/22/00 Orlando, FL

Board Members Present: Greg Jones, WD5IVD John Ackermann, N8UR, Vice President Mel Whitten, K0PFX John Koster, W9DDD Bob Hansen, N2GDE, Secretary Steve Bible, N7HPR Doug McKinney, KC3RI Steve Dimse, K4HG

Not Present: Barry McLarnon, VE3JF Jim Neely, WA5LHS, Treasurer

### Election of Officers

The following were elected for one year terms:

President: John Ackermann  
Vice President: Steve Bible  
Secretary: Bob Hansen  
Treasurer: Jim Neely

### Reports

#### Treasurer

The Treasurer's report was posted online prior to the meeting. The report was accepted.

#### PSR

Bob stated his intention of resigning as PSR editor "sometime in the year 2001."

### **tapr.org**

Greg reported on the need to upgrade the web server system. The Board authorized up to \$2500 he spent to upgrade the secure server for [tapr.org](http://tapr.org).

## **Project Reports**

### **SS Radio**

Problems continue to plague this project, especially with the digital board. Fred Peerenboom, KE8TQ, is the new project manager. There is concern about continuing to get development time from some of the key team members.

Doug McKinney raised the need to better document TAPR's project development process better. He volunteered to put together a proposal.

### **HamHUD**

This device displays APRS data on a scrollable LCD display. Steve Brigg is now working on version 3. No Board action required at this time, may need support later when the project is ready to be turned into a product.

### **Vocoder**

Charles Brain, G4GUO, is working on a new version of the Voice Encoder. For additional information see [www.chbrain.direcon.co.uk/dvhf.html](http://www.chbrain.direcon.co.uk/dvhf.html). John Koster is the project manager.

### **CFA Version 2**

Another version of the Compact Flash Adapter is being developed which supports Type 2 PC cards (which are available in larger sizes, up to 1 Gigabyte), and has other small improvements.

### **TUC-52 / MetCon-2**

Documentation still needs to be finished.

### **T-238**

This is a mini weather station using Dallas Semiconductor 1-wire sensors. Unfortunately, the Dallas 1-wire weather station is no longer available. However, there is still some interest in the kit and it was decided to make a limited production run (maybe 50 kits).

### **Easy Track - Rotor Controller**

This kit is not just for satellites, but can be used for applications such as balloon tracking. The rotor interface and hardware are complete. Steve Bible is currently working on the software. Some of the difficulties encountered include accurate motor control, differences in the interface for different radios, and the 8k memory limit of the chip used.

The memory limit was being approached because of the desire to include the protocols for many different radio (serial) interfaces. A possible future project would be to develop a Radio Protocol Interface Chip which could translate any radio protocol to a standardized interface. Application devices could then just use the standardized interface.

### **DSP-10**

This is an all-mode 2-meter transceiver using a DSP IF. It was developed by Bob Larkin and described last year in QST. Steve Bible has developed a dialog with Bob and is creating documentation for using the hardware in different applications. Steve will investigate the possibility of turning this into a TAPR kit.

After discussion of the DSP-10 and other projects, it was clear that the industry trend of using more surface mount components would make it more difficult to produce kits that can be assembled by amateurs. Another kit idea brought up was some kind of easy surface mount kit that could be used for learning proper surface mount construction techniques.

## **Publications**

The new DCC CDs are now available.

Greg is beginning to scan old *PSRs* for the newsletter CD set.

The TCP/IP book will be delayed until after Greg completes his dissertation.

## **Regulatory Issues**

### **UWB and NPRM 98-153**

The FCC mindset of frequency band allocations is counter to the concept of Ultra-Wide Band transmission systems. Duane Hendricks agrees with the comments of the ARRL on the NPRM; recommends that TAPR does not need to file any comments.

### **RM-9949**

This is the ARRL proposal to upgrade a segment of 2.4 Gigs from secondary to primary status for Amateur Radio.

### **Multi-Use Radio Service (MURS)**

The FCC has created a new unlicensed service (Part 95, Subpart J) around 150 MHz. The maximum power output is 2 watts, but there are no modulation or content restrictions. More information is available at [www.provide.net/~prsg/mur/home.htm](http://www.provide.net/~prsg/mur/home.htm). What implications does this have for ham radio?

### Misc. Old Business

Doug is still evaluating Easy-PC schematic capture and PCB software.

**APRS Working Group** - The specification has finally been approved. The working group is recruiting some new members to replace those who have left.

### New Business

#### SDR Road Map

Steve Bible gave his view of the future of radio: Software Defined Radios (SDR). It is the convergence of the technologies of DSP, FPGA, higher speeds, etc. He showed off his DSP-10 and talked about how hams could easily develop this new technology. In order to make it possible, all the steps need to be documented so that they can be integrated together and people can build on each other's work.

#### Organization Roles

John Ackermann expressed his desire to better define specific roles and responsibilities in the organization, and the need for individual Board members to represent each role to the Board. (The roles would be things like: membership, marketing, publications, etc.) John will generate a list of roles and post in the on-line session.

*Submitted January 2, 2001, Bob Hansen, Secretary.*

---

### TAPR Board of Directors Online Meeting Minutes - Quarter 2, 2000

*[The TAPR Board of Directors holds a continuous meeting on a private mailing list. This is a summary of the discussions in that forum.]*

#### Financials

The summarized financial statements as of the end of 1999 were reviewed. According to Jim Neely, Treasurer: in layman's terms, TAPR showed a \$25,000+ net gain for the year. Cash looks good, so whatever we're doing, it's working pretty well.

Jim also agreed to continue as TAPR's treasurer. The board also expressed the desire to become more familiar with both the financial transactions of the organization as well as the office operations. A meeting is to be scheduled with Jim and one or more Board members (possibly at the DCC).

#### TNC-2 License

Dave Sumner asked whether TAPR might be able to make a limited license for TNCs available to TRAC, the national amateur radio organization in Turkey.

The major points brought up included:

- TAPR doesn't have the source code.
- TAPR no longer has electronic copies of the artwork or documentation.
- The design is old and some of the parts are obsolete.
- It was not clear what it is they really want.
- Possible import restrictions to Turkey.

#### SS Radio Group Buy Possibility

An offer of 20 surplus data radios was made. From past experience with the manufacturer, it was felt that the quality of the radios was low and not worth the cost.

#### PIC KISS TNC

John Hansen expressed interest in having TAPR sell a PIC based KISS TNC that he has developed. Some general discussion of kit pricing models occurred and it was decided that a Memorandum of Understanding (MOU) needed to be developed with John regarding this kit.

#### Miscellaneous

- Various discussions in preparation for Dayton were held.
- It was noted that the [anipr.org](http://anipr.org) domain had expired due to lack of payment of the fee to Network Solutions. Greg Jones to follow up with Bdale Garbee.
- It was suggested to look at [www.hearst.com/products/voicecreator/](http://www.hearst.com/products/voicecreator/) as a possible method to hold interactive Board meetings or other discussion groups. Doug McKinney plans to investigate this further.
- Some web site updates being done by Greg Jones.
- TAC-2 kit sales and replenishment of inventory were discussed. A run of 25 kits is planned.
- The need to get someone to do additional updates to the web site was brought up.

*Submitted December 31, 2000, Bob Hansen, Secretary.*

---

### TAPR Board of Directors Online Meeting Minutes for Quarter 3, 2000

*[The TAPR Board of Directors holds a continuous meeting on a private mailing list. This is a summary of the discussions in that forum.]*

#### Preparation of KISS TNC MOU

A Memorandum of Understanding (MOU) was prepared to handle sales of the PIC-based KISS TNC developed by John Hansen. The main issues discussed were:

- selling vs. purchase price
- exit conditions
- quantity commitment
- product name

- timely resolution in time for publication in QST

### Pharos iGPS180

Doug McKinney is using the Pharos iGPS-180 GPS engine in his business and offered to sell units to TAPR at a discount to the regular single quantity price. Having TAPR sell these to interested hams would increase his purchase quantity and allow him to provide them to TAPR at the discount rate.

Koster moved that we accept the offer and move forward.

There was no second or further discussion.

### Minutes

The Board on-line minutes from Quarter 1 and from the HamVention were posted. Ackermann moved to accept the Q1 and Hamvention Secretary's report as submitted. Seconded by Bible. Motion was unanimously accepted.

### Financial Statements

The June financial statements were posted by Jim Neely. He notes we spent \$8350 more than we took in during June, but that the year to date looks good.

There was a question on about an account listed as EQUIPMENT-FLORIDA. This is really the equipment and inventory now in Oklahoma, but the account name was never updated.

### TAPR Credit Card

There was a request by the DCC organizers to have access to the TAPR credit card to make it easier to handle miscellaneous expenses while planning and running the DCC.

There is no TAPR credit card. Dorothy has a card which is basicaly used for offices expenses (petty cash) and ordering parts. The only other major purchase we put on the card each year is the DCC hotel cost at the end of the conference. When we close the contract on the hotel, Greg reviews the contract, signs it, then calls the hotel and provides the credit card information.

For people other than inventory and office equipment/software/supplies the amounts are small enough and infrequent enough to ask for people to submit reimbursement sheets. Allowing several people access to the card would also make it more difficult to reconcile bills.

### APRS Working Group Status

Ackermann expressed his frustration with the lack of progress of the APRS Working Group in approving the latest protocol specification. Some discussion occurred on what TAPR could do to expedite the process.

Eventually, both the quorum and a supermajority of the Working Group approved the version 1.0.1 specification document, so no further action was required other than to publish the specification.

### SIG Mailing Lists

Ackermann forwarded a message from Stan Horzepa, administrator of the APRS SIG and the APRSSPEC SIG.

It said that there have been a lot of long, esoteric threads on APRS SIG related to the APRS protocol and the inner workings of the system that have left the majority of SIG members exasperated. Since the message threads are on-topic (i.e., APRS), there is little he can do to squash them. But, he fears that the SIG will lose its value to the average user if the present trend continues.

To alleviate the problem, Stan proposed to:

1. Change the scope of the APRSSPEC SIG. Instead of just discussing APRS SPEC issues, it would be a forum for ALL protocol issues and discussions concerning the inner workings of the APRS system.
2. Change the scope of APRS SIG to ban the discussion of protocol issues and focus more on user topics.
3. If the SIG members don't get the message, to begin moderating the APRS SIG.

Ackermann responded that Stan's proposal looked sound and suggested that he also discuss the issue with Steve Dinse.

Another concern was raised on the lists regarding spam:

"Why isn't the mailing list blocking messages from automated systems/spam/other mailing lists? and if it is a subscribed mail address, why isn't Lyris double checking?"

Good question. The answer is that this question has come up several times in the past, and after debating it, we've always ended up opting for an open list because of the hassles of the closed list format.

The problem with a closed list is that many folks post from addresses that are different from their subscribed address (this doesn't necessarily mean two separate accounts - many complex email environments show a "From" address that's different than the subscribed address). For those people, a "subscribers only may post" policy causes problems. And, dealing with those problems is a "big" burden on the list administrator. On small lists, this isn't a big deal, but aprsig has something like 1600 subscribers and that changes the equation.

So, our view has been that the (relatively few) spam messages that get through is an acceptable price to pay for avoiding these problems. If there's a strong feeling

that things should change, we'll certainly consider it. To be honest, one factor in the decision will be whether the list moderators are willing to undertake the extra work this would entail.

### Software Defined Radios

Steve Bible submitted a lengthy message sharing his thoughts about Software Defined Radios (SDR). He basically feels that SDR is an exciting approach with many possibilities for amateur involvement. One is that many tech savvy people are computer types, but RF is a foreign concept to them. This type of radio opens up the work of radio to computer types. So instead of designing and building a demodulator in transistors and MMICs, he does it in software. Second, this introduces RF to those who are intimidated by it. Third, here's where we can draw RF experienced types into the digital world.

Last year in the Sep, Oct, and Nov 1999 QST, there was a series of articles entitled "The DSP-10: An All-Mode 2-Meter Transceiver Using a DSP IF and PC-Controlled Front Panel" by Bob Larkin, W2PVA. Bob's DSP-10 is a SDR by any other description.

Steve had no specific proposals to the Board. He wanted to introduce the subject and get TAPR's support of this concept. Several positive responses from the Board were submitted, and Steve was encouraged to pursue this further.

Steve later contacted Bob Larkin, the designer of the DSP-10, on the possibility of having TAPR produce a kit based on the DSP-10. Bob was quite excited at this suggestion, and Steve will continue to pursue this.

### NADSD

What about the NADSD? I think we either need to have someone to keep it current, or close it down. Frank Aguilar, N3SSH, managed the NADSD kits for TAPR. I suspect that whatever made him too busy to handle the TPRS database probably also had the same impact on the NADSD.

The problem is the project is dependent on the input of a lot of individual groups, and I suspect few of them are updating the raw information (any way to check?). Without a dedicated set of inputs, there doesn't seem to be much point.

### Life After Greg

Notes from working session of 5/18/2000 regarding re-assignment of tasks formerly done by Greg Jones:

- Web page maintenance.  
Steve Dimise with help from Steve Bible.
- Record DCC audio and encode as MP3  
Greg will handle until DCC with Doug as backup
- Mailing list administration (for new lists)

Lynis and Lee Ziegenhals

- CD-ROM Generation  
Greg will continue for now.  
An automatic duplicating machine costs \$8000.
- PSR articles  
Bob will send weekly reminders for PSR deadlines.
- Look and Feel for Documentation  
This includes kits, flyers, product sheets, and books.  
Steve Bible will convert to Word templates for use by document-creators.
- Office support and management  
We need to do a brain dump of Greg. Office is running on its own for now.
- Database administration. (Membership database and Point of Sale system)  
Greg will continue for now
- Project management  
Steve Bible
- Parts ordering / inventory control  
Steve Bible and Joe Borovitz
- DCC overnight  
Tina Stroh and Sheila Bible  
Steve Stroh: ARRI liaison, workshops, speakers, PR, mailings, agenda, single point of contact
- Product line manager (what sells)  
Steve Bible

### Inventory

We talked at Dayton about Joe selling off the surplus inventory to make room for future stuff. I think Steve B was working with him on that.

### Kits and Products

#### T-238 Kits Sold out

The TAPR T-238 Kits are sold out. That's 100 kits sold in 5 weeks. Not bad. But the discontinuing of the Dallas Semiconductor Weather Station hit the kit hard. Without a weather station to hook up to it, I doubt sales will continue and thus I've decided for the moment not to make any more kits. There is rumor that the Weather Station will resurface. If so we'll bring the T-238 back when the demand returns.

#### Obsolete Kits

The board should think about removing the following kits from production and placing them into the old kits column -- we either have very few kits left or are out totally. Someone should check with Dorothy to see what we have in stock and with Joe to see what he might be able to kit from stuff he has.

- FVM-RJ
- MIC-Encoder
- DPGS (the old one) not sure what the status of the one for the M-10 is. We get these from Doug.



- PK-232 DISC Header
- 9600b modem — I think we have like 10 boards left...so can do 10 more kits after that I don't think it would be worth the effort to run another board run. I was hoping we would have a FPGA design going by now.
- 32K SRAM Upgrade -- Maybe John can look at the list I handed him at the DCC to see if we even sold any of these.
- AN-93 (this kit never got completed — it is close but never found someone to finish the checkout and get the kits shipped — we have like 100 kits with minor fixes to the docs that is required). I sent all the parts back to Joe to be put back into inventory. We have I think 90 orders for it and a letter probably needs to go out to those saying that we are not doing the kit now and probably add in a gift certificate or something. With the emergence of Soundcards and software this kit is really out of the running.

## DCC

Various discussions were held in preparation for the DCC in Orlando. After the DCC, suggestions and comments were collected for future improvements:

Possible Seminars:

- How to make a PCB (aka ExpressPCB demo)
- SMT Soldering Seminar
- DSP Intro Seminar
- Ultra Wide Band (UWB)
- SDR

APRS Seminar - Make it all day Friday. Most APRS papers submitted to the DCC should be presented on Friday. Pick and choose some for Saturday.

- Conduct the membership meeting differently.

## Greg Jones Resignation

I guess I'll make this my official stepping down message;-) I'll be around to help but my level of visibility needs to be reduced to zero in order to allow you guys to mold TAPR into what you think it needs to be now. I had my chance and got us to the point to give you guys a lot more flexibility then I had when I took over. As you all know when I took over we had almost no membership, had no cash flow, had to move and restructure the business side of things, and work with no real cash in the bank. What we had was a few volunteers willing to work. Sometime that is all it takes. Hopefully you can take the organization a little further down the road and hand it off to someone else. That is about all we are responsible to do.

## TAPR Name

Some discussion was held on officially changing the name of the organization to TAPR, Inc. in order to move

us away from having to explain Tucson (and even Packet, since we're broader than that).

That is what Greg has been doing informally for sometime now. A lot of the stuff that goes out is just TAPR. We are listed in a lot of the accounts we do have for parts as just TAPR.

The TAPR name is a tradition, but shortening it to "TAPR, Inc." was now seen as more appropriate, reflecting our efforts in the digital world we are in the middle of. The question was raised of what impact this would have legally and on items such as printed materials, checks, etc.

*Submitted January 1, 2001; Bob Hansen, TAPR Secretary*

## TAPR Board of Directors Online Meeting Minutes Summary for Quarter 4, 2000

*[The TAPR Board of Directors holds a continuous meeting on a private mailing list. This is a summary of the discussions in that forum.]*

### Financial Statements

Financial statements for August, October, and November were posted to the list and reviewed.

### North American Digital System Directory

The board discussed the status of the NADSD. Since there is no one maintaining it, and input is spotty, it was recommended to leave it on the web page, but post a notice that some of the data may be out of date.

### Director Roles

John Ackermann proposed that the directors take on formal responsibility for specific subject areas. The suggested areas included:

- Membership Director
- Marketing Director
- Project Director
- Manufacturing Director
- Publications Director
- PSR Director
- Web Director
- SIG Director

### New Directors

Discussions were held on who to appoint to director positions vacated by Greg Jones and Barry McLarnon.

Here is Barry's resignation statement:

I just want to say that it has been a genuine pleasure to be involved with the board of TAPR, one of the very few organizations (or should I say the only organization?) in the hobby that has escaped the trap of becoming a stodgy

self-perpetuating bureaucracy. I regret that my interest in packet radio matters has waned in recent years, and I can't justify occupying a board position when I'm not prepared to do a reasonable share of the work that needs to be done. Hopefully, the board can use the remaining year of my term to allow some "new blood" to get involved and make a contribution.

Needless to say, I intend to remain a TAPR member (in good standing since 1985), and I'll continue to lurk on the periphery... who knows, I may even jump into a project or two at some point. In the meantime, I have no sage advice to dispense... TAPR's strength has always been the core of do'ers on the board (with Greg in a class by himself, of course!), and that's as healthy as ever - so, keep on do'in!

Happy holidays to all,  
Barry

### DCC and Dayton Activities

Greg provided a brain dump of issues related to running the DCC and the events at Dayton.

### TCP/IP Book

The board discussed the current disposition of the TCP/IP book and about the best way to distribute it.

### Digital Voice

Some discussion of digital voice in general, and the vocoder project in particular were held. The consensus is it's too early for setting standards.

### Web Pages

Greg provided some advice on how the web pages are structured and the best ways to update them.

*Submitted February 17, 2001; Bob Hansen, TAPR Secretary*

---

## ARRL and TAPR Digital Communications Conference Proceedings Now Available on CD-ROM

The Digital Communications Conference and the Computer Networking Conference proceedings are now available on CD-ROM. The reason is simple, the supply of printed versions of these older proceedings are running out. We wanted to make sure these proceedings and others will still be available once the printed versions were gone. The proceedings have been converted to PDF and are searchable as well as printable. There are currently 3 discs available.

### Disk 1 - Proceedings #1 - 10

This CD includes the conference proceedings saved in Adobe Acrobat PDF format and can be searched or printed.

Price: \$33.00 includes available proceedings in print.

- 10th Computer Networking Conference 1991
- 9th Computer Networking Conference 1990
- 8th Computer Networking Conference 1989
- 7th Computer Networking Conference 1988
- 6th Computer Networking Conference 1987
- 5th Computer Networking Conference 1986
- 1st-4th Computer Networking Conference 1981-1985

### Disk 2 - Proceedings #11-16

This CD includes the conference proceedings saved in Adobe Acrobat PDF format and can be searched or printed. Audio and overheads from each conference are included as available. Audio from the conferences are presented in RealAudio format.

Price: \$33.00 includes available proceedings in print.

- 16th Computer Networking Conference 1997  
(CD contains Conference Audio)
- 15th Computer Networking Conference 1996  
(CD contains Conference Audio)
- 14th Computer Networking Conference 1995
- 13th Computer Networking Conference 1994
- 12th Computer Networking Conference 1993
- 11th Computer Networking Conference 1992

### Disk 3 - Proceedings #17 - 19

This CD includes the conference proceedings saved in Adobe Acrobat PDF format and can be searched or printed. Audio and overheads from each conference are included as available. Audio from the conferences are presented in RealAudio format.

Price: \$33.00 CD-ROM only.

Price: \$50.00 includes available proceedings in print.

- 19th Digital Communications Conference 2000  
(CD contains Conference Audio)
- 18th Digital Communications Conference 1999  
(CD contains Conference Audio)
- 17th Digital Communications Conference 1998  
(CD contains Conference Audio)

## TAPR 900MHZ FHSS Radio Design Update

Fred Peerenboom, ke8tq  
January 28, 2001

After all has been tossed about in this project it seems that the principal players out there, i.e. the guys doing the work, are doing a bang up job. It is taking software hacking, hardware hacking and a lot of prime time away from the other aspects of the hobby to get things to this stage. I am hopeful that we will be able to get more frequent updates out to the web page so that all of you can follow progress closer.

### Digital board status

After much head scratching, software massaging and hardware hammering, the crew reports that it is finally starting to see a glimmer of light at the end of the tunnel. To this date they have the following accomplished:

1. Ethernet interface is working.
2. The Serial interface is working.
3. Download of FPGA appears good.
4. The SDSI version 7.4 tools have their problems fixed and are working.
5. HTTP server is functioning properly.

Items that need to be tested and hammered out include

1. The total DC current draw of the operating board.
2. Fully wring out the FPGA.
3. Check out the D-A converter base-band data output.
4. Check out the A-D converter base-band data input.
5. Run the Harris demodulator through its paces.

Check out the two screen shots that Tom McDermott has provided to get a preview of what things will look like. There have been many software fixes and programming changes made by Tom in this endeavor as well as the hardware hacking. It looks like it is now coming to fruition with this progress report.

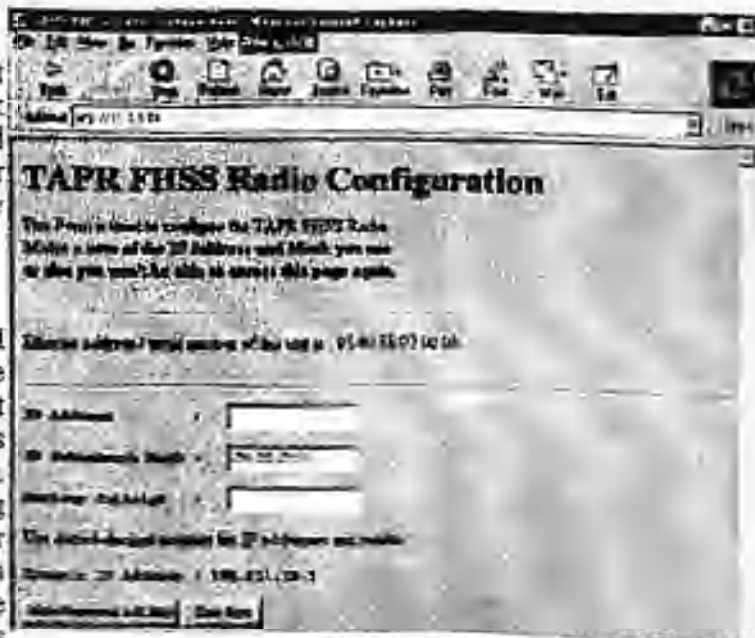
### RF board status

The crew reports that the transmitter is getting good signals to the RF PA at this point but the output of the PA is only +15dbm instead of the +30dbm that it should be. One theory for this is that perhaps there is something wrong with the output-matching network. It was also learned that the RF T/R switch is showing in excess of a 10db loss on TX. The RF low-pass filter is showing the same problem on transmit, but on receive has a very small amount of loss. The receive LNA has no gain showing, but on the bright side it is showing no loss either. That is about a 15db problem.

Educated guesses point to the matching network on the output again for this problem.

The mixer/down-converter is not producing an 85 MHz IF output. The LO signals are good; the RF signals are low due to the LNA problem mentioned earlier.

One other bright picture here is that the TX I/Q modulator has very good carrier balance without null adjustment, running better than the -70 dBC measurement limit.



## Digital Radio in the New Millennium – Some Thoughts on Where We Are, and Where We're Going

John Ackermann: N8UR  
President, TAPK  
n8ur@hipr.org

The dawn of the 20th century saw tremendous technological change. Within a decade or two either side of 1900, the telephone, automobile, airplane, and wireless all came into widespread use. All these developments served to bring people closer together, making the world a smaller place.

When future pundits examine the beginning of the 21st century, I think they will find that similarly profound changes took place around 2000. In particular, they will see that technology was creating an even smaller world, one bound together by digital communications. The Internet today, as big as it is, is only a working model of the digitally connected world we'll see in another few years. And while today wireless networking is just coming into its own, uncluttered digital systems will become a larger and larger part of the interconnected world of the future.

In short, the technology transformation going on right now is the shift from a wired analog world to a wireless digital one. And hams ought to be right in the middle of it. Are we?

It's easy to say that amateur radio is not keeping up with the times -- after nearly 20 years, most packet activity is still at 1200 bps while the typical telephone modem now claims 56 kbps, and in many areas wideband access at hundreds of kilobits per second is available. As a result, "traditional" packet activity like BBS operation is disappearing in many parts of the world. From that, many folks assume that "packet is dead." More generally, there seems to be a common view that ham radio has lost its ability to innovate. I disagree with both these perceptions.

We are continuing to innovate, and we have at least two windows of opportunity for important advances that will keep amateur radio meaningful for a long time to come. One of them involves better application of things we already do, while the second puts us on the leading edge of technical development. The rest of this article introduces those areas where I think we can make a real difference if we move quickly.

And we *must* move quickly, because time is short. The commercial world will pass us by if we decide to think about these things for a few years before doing them.

## Portable Wireless Data Networks

We're already heavily involved in an activity that the commercial world is just starting to exploit: portable and mobile wireless data communications. I think we have a window, a short window of perhaps 18 months, to integrate the technologies we've already developed -- first and foremost, APRS, but also our TCP/IP networks -- into tools that are useful to the community at large. In the US, one of amateur radio's reasons for existence is to provide public service, and integration of APRS and other data tools into our toolkit could add a lot of value. Let me point out just a few of the possible applications.

First, there's traditional APRS activity. Tactical position information is neat, and weather stations provide valuable information (a fact which the US National Weather Service is starting notice). However, the messaging capability in APRS is a tool that we need to sell as well. APRS messaging is as capable as the mobile phone messaging systems that are starting to appear. Short, real-time messages from portable devices can be very valuable in an emergency situation. In addition, the "tiny web pages" that APRSers are now using can convey information as usefully -- if not quite as graphically -- as any of the portable web devices.

Our capabilities aren't limited to APRS. There are public service applications where we need to move more data than the APRS model supports. We could be doing much more with our existing packet radio technology, particularly TCP/IP applications, than we are. We could be providing portable (laptop-based) systems with email, conferencing, and even modest graphics capabilities, at a very reasonable cost.

This isn't meant to be a how-to guide, but consider this. We have all the pieces necessary to build portable 9600 baud, TCP/IP capable systems, using a web browser as the interface, for perhaps \$300US each. Start with a Tekk radio that will give you a couple of watts at UHF, and handle 9600 baud nicely, for less than \$150 (or convert surplus UHF HTs for even less). Add a Baycom 9600 baud modem that attaches to a computer parallel port and costs less than \$100. Use SV2AGW's Windows 98 network driver software, which costs \$28 to register, and get rid of the excuse that TCP/IP requires a user-hostile program like JNOS. Or, run Linux, which supports the Baycom modem directly and lets your station be a network service provider, rather than simply a user.

Add a second-hand laptop and a UHF yagi antenna, and you have a complete portable packet station that can do email, multi-user conferencing, and even web browsing using a familiar graphical interface; with the SV2AGW software, you can use the same web browser, email client, etc. that you use when on-line. To provide solid coverage for those low power radios, you might want to build a

UHF digital repeater (which can be a surprisingly low cost project).

Do you think your local emergency group could be convinced that a capability like this would be a good idea? It may take some work to integrate these stations most effectively into emergency communications plans created with only voice comms in mind, but the end result could be drastically improved communication reliability during a crisis. And, by the way, when there's no emergency going on, these systems could be a lot of fun to play with; how about providing a local "chat" server, or even RF-based web pages, for local users?

Better use of APRS and portable data terminals in public service communications is an exercise in systems integration using technology that's already available. The challenge is much more political than technical; it's a matter of making packet radio visible and available to the other aspects of our hobby.

At present, the amateur APRS network in the US has coverage that exceeds any of the commercial systems, and we have the distinct advantage of being able to change our network very quickly to adapt to communication emergencies. But we only have a short window of opportunity. The commercial services are out there and they're growing. They have public awareness that we don't. Web-enabled mobile phones and wireless devices like Palm-Pilots are quickly entering the marketplace and the public eye. We need to move quickly to make APRS and other packet operations an integral part of emergency communications planning before our capabilities are overtaken by the commercial telecom providers.

### Software Defined Radios

Our second window of opportunity is a bit more futuristic. It moves us away from packet radio and into the broad area of digital radio. The buzzword is "Software Defined Radio," or "SDR." In short, an SDR is a radio that replaces most of its analog components with digital signal processing ("DSP"). DSP is the use of special purpose CPUs to process signals in the digital domain. DSP can implement frequency conversion, filtering, modulation, and demodulation in software. Because these functions are defined by software, not hardware, DSP designs are extraordinarily flexible.

We can't do it now (at least not economically), but the ultimate SDR vision is a radio in which the only analog components are the power amplifier and receive preamp. Those devices connect to high-speed digital-to-analog and analog-to-digital ICs and all the lower level stages are done by DSP. The flexibility of such a radio is enormous. It can operate on any frequency within its design range, using any bandwidth and any modulation scheme, with no hardware changes. The radio is defined by its

software, and to change its characteristics, you simply change the software.

Why are SDRs important to ham radio? Many hams complain that experimentation is no longer possible because the technology needed to be on the leading edge, such as tiny surface mount components with hundreds of leads, is too difficult for most amateurs to work with, and too expensive to buy for experimental purposes (blowing up a \$100 IC creates a different feeling than smoking a resistor!). There's also a very real availability problem for "old fashioned" components with wire leads. And, technical information on the special-purpose chips that have replaced traditional components may be very hard to come by.

These problems combine to make it more difficult for hams to do leading edge hardware products. The SDR offers a different way for us to view experimentation. An SDR with an open design and open software can provide a perfect platform for ham tinkering.

Picture an SDR with a frequency range of 10kHz to 30MHz (we can do better than that, but let's keep it simple). With a box like that sitting in your shack, and some development software running on your PC, there's no HF mode that's beyond your reach. Moving from AM on 160M to digital voice with forward error correction on 10M requires no rebuilding, just reprogramming.

With SDRs, our emphasis shifts from hardware to software, and we use compilers rather than soldering irons, but we are back in the business of "advancing the radio art" through experimentation. It's a paradigm shift, and it may be uncomfortable, but it's one we'll have to make sooner or later; the commercial world is moving toward SDRs, and there's no reason we shouldn't be moving with them. In fact, we have a window of opportunity to be on a par with the commercial interests. SDRs are new, and the commercial world hasn't figured out just what the standards should be. If we move quickly, we can help *create the standards*.

Just as open source software like Linux has shown that hackers can compete on even terms with the big boys, a ham SDR platform can let us go eye-to-eye with commercial radio developers. Clever programming doesn't require multi-million dollar research facilities.

Now, we can't do the ultimate SDR yet. Components that operate at VHF and even HF frequencies are still far beyond the ham budget. However, those prices are coming down, and in the meantime, we can get our feet wet with a hybrid SDR that resembles a traditional radio down to the last IF in the receiver, and the modulator in the transmitter. The "back end" of the radio is replaced by low cost DSP components that are available today at reasonable prices.

In fact, a computer sound card can be the heart of an SDR designed for HF narrow-band modes like PSK31. QST published an article about such a beast last summer. A slightly higher-performance DSP engine can handle wider bandwidth modes like SSB, AM, and FM. The DSP-10 2m radio project, also published in QST, shows an example of this. These projects are just the start of what we can do with SDRs; all we need is to get the hardware engines and software tools out to the experimenter community.

### TAPR's Role

What's TAPR doing to support these two initiatives, to help us take advantage of the windows of opportunity before us?

We've been supporting wireless networking for a long time. TAPR is the primary meeting ground of the APRS community, and we will continue to support advances in APRS. We will also support development of the portable network terminal concept I described, although frankly the challenges we face with this project are political, organizational, and operational, not technical.

On the SDR front, TAPR has committed to help make SDR kits available to the ham community, and to support those who want to develop code to run on these engines. We hope to announce our first kit shortly, and we already host a DSP mailing list where coders have been discussing software modem design techniques for quite a while. TAPR sees the Software Defined Radio as a perfect opportunity for our "enabling technology" philosophy — by making general purpose SDR engines, and the tools to program them, available, we enable hams to once again become experimenters on the leading edge of communications technology.

TAPR is a membership organization, our ideas come from people who are passionate about radio. We help those people turn their ideas into products that benefit ham radio. What are *your* ideas? We'd love to hear from you, and if you're as excited about the future of ham radio as we are, we'd love to have you as an active TAPR member.

### TAPR DCD with MX614 Modem

Steve Bible, N7IIPR

*[The following is a summary of a discussion thread from TAPR's PIC SIG.]*

Boy, has this thread spread its branches. Let me try and summarize a few comments and make an input that hopefully helps point people in the right direction.

Jay, KA9OKT first asked:

Does anyone know if the TAPR DCD mod will work with MX614 modems based TNCs? We can get very inexpensive modems now, but radio's are still pretty expensive. MFJ's data radio is the cheapest one but it doesn't provide squelched audio so won't work with cheap modems. If it will work, are there wiring directions anywhere? If anyone has any ideas, I would appreciate them.

James Jefferson said:

TAPR's DCD kit needs a clock signal to work. If you can generate the clock in the software and feed it into the hardware then it will work.

The DCD kits are still available. However, as James mentioned, the TAPR DCD mod kits assume installation in a TNC-2 thus the requirement to have a clock signal.

It is possible to construct a "hardware" DCD using the XR2211 chip without a clock. Take a look at the XR2211 data sheet and there's a configuration of the 2211 that can be used for DCD detection.

You can also implement a DCD in software such as James has:

I implemented the TAPR kit in a PIC. The edges are a little rough, but it shouldn't take much effort to make it work. Try looking at: [www.dorkmedia.com/~jjeffers/pic2/pic/](http://www.dorkmedia.com/~jjeffers/pic2/pic/)

or John Hansen:

Shameless plug: The PIC KISS mode TNC that I did for last November's issue of QST is MX-614-based and has software DCD built into it, so it can run open squelch.

Also take a look at the TAPR DCD mods web page at [www.tapr.org/tapr/html/dcd.html](http://www.tapr.org/tapr/html/dcd.html)

You can download the assembly manual. Though I did just check it and see that the schematic diagrams are not in it. Must be from the old days of photo ready manuals :-).

The kits are an extension of Eric Gustafson's paper "Can We Continue to Ignore Level One?" in the 7th CNC. I would recommend reading Eric's paper. Here's the abstract from:

[www.tapr.org/tapr/html/Cnc07.html](http://www.tapr.org/tapr/html/Cnc07.html)

ARRL 7th Computer Networking Conference 1988

Can We Continue to Ignore Level One?

by Eric S. Gustafson, N7CL

Abstract: For some reason which I cannot fathom, there has been a great reluctance to specify or even to provide guidelines for the various level 1 issues in the amateur packet radio system. This reluctance traces back all the way to the very early days of packet radio development. I find this situation very strange indeed since if level 1 isn't working, all the other levels of the protocol which everyone seems eager to specify down to the last bit position are all irrelevant.

In this paper I will choose one of the most consistently botched and yet most easily corrected level 1 parameters, the modem's data carrier detector. I will show how the performance of our present packet systems can be improved by careful consideration of even just this simple level 1 issue.

Tony, KD7TA, mentioned the PacComm DCD mod kits. They are essentially the same thing as the TAPR DCD kits. There are two DCD mod kits sold by TAPR. One of which works with the TCM3105 modem chip. The mod taps off a clock signal that comes from the TCM3105.

Guy Story, KC5G01, mentioned that the MX-614 has energy detect, which is true. It is not the same as DCD. Energy detect still requires a squelched signal. It'll detect energy when the squelch opens (pretty simplistic actually).

Jay, you may want to order the proceedings either on paper or CDROM from TAPR. Many of the early packet work has been documented in the CNC (now called DCC) proceedings.

Hope this helps.

## TAPR Looking for Volunteers

In order to provide a better quality newsletter, TAPR is asking for volunteers to help with its production. We are looking for people who are willing to perform one or more of the following tasks: summarize SIG discussions, event reporting, general article writing, soliciting articles, copyediting, layout, graphics/artwork, web page production, etc.

If you think you are interested in helping TAPR produce its newsletter and/or web site, please send your name, phone number, and areas of interest to:

John Ackermann n8ur@tapr.org, or  
Bob Hansen n2gde@tapr.org.

## Statement of Ownership, Management, and Circulation

1. Publication Title <b>Packet Status Register</b>		2. Issue Date <b>30 SEP 2000</b>	
3. Issue Frequency <b>QUARTERLY</b>		4. Annual Subscription Price <b>\$70.00</b>	
5. Complete Mailing Address of Known Office of Publication (Street, City, County, State, and ZIP+4) <b>TUCSON AMATEUR PACKET RADIO PO BOX 5114 DRAPEL, TX 76206-1114</b>			6. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not for use as office of publication) <b>TUCSON AMATEUR PACKET RADIO PO BOX 5114 DRAPEL, TX 76206-1114</b>
7. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not use an office address) <b>ROBERT HANSEN - N2GDE 266 PROSPECT HILL RD HUNTSBACH NY 14860-2572</b>			
8. Full Names and Complete Mailing Addresses of Owner(s) <b>ROBERT HANSEN - N2GDE 266 PROSPECT HILL RD HUNTSBACH NY 14860-2572</b>			
9. Owner's Declaration: I, the publisher, certify that the information furnished on this form is true and complete. I am not aware of any information which would cause this statement to be untrue and I am not aware of any person who furnished information which would cause this statement to be untrue.			
10. Publication Title <b>TUCSON AMATEUR PACKET RADIO</b>		11. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not for use as office of publication) <b>266 PROSPECT HILL RD HUNTSBACH NY 14860-2572</b>	
12. Issue Date for Circulation Data Below <b>August 2000</b>			
13. Extent and Nature of Circulation		14. Sales Data for Circulation Data Below	
a. Total Number of Copies (Net press run)		Average No. Copies Each Issue During Preceding 12 Months	
1. Total Number of Copies (Net press run)		2. Total Number of Copies (Net press run)	
3. Total Number of Copies (Net press run)		4. Total Number of Copies (Net press run)	
5. Total Number of Copies (Net press run)		6. Total Number of Copies (Net press run)	
7. Total Number of Copies (Net press run)		8. Total Number of Copies (Net press run)	
9. Total Number of Copies (Net press run)		10. Total Number of Copies (Net press run)	
11. Total Number of Copies (Net press run)		12. Total Number of Copies (Net press run)	
13. Total Number of Copies (Net press run)		14. Total Number of Copies (Net press run)	
15. Total Number of Copies (Net press run)		16. Total Number of Copies (Net press run)	
17. Total Number of Copies (Net press run)		18. Total Number of Copies (Net press run)	
19. Total Number of Copies (Net press run)		20. Total Number of Copies (Net press run)	
21. Total Number of Copies (Net press run)		22. Total Number of Copies (Net press run)	
23. Total Number of Copies (Net press run)		24. Total Number of Copies (Net press run)	
25. Total Number of Copies (Net press run)		26. Total Number of Copies (Net press run)	
27. Total Number of Copies (Net press run)		28. Total Number of Copies (Net press run)	
29. Total Number of Copies (Net press run)		30. Total Number of Copies (Net press run)	
31. Total Number of Copies (Net press run)		32. Total Number of Copies (Net press run)	
33. Total Number of Copies (Net press run)		34. Total Number of Copies (Net press run)	
35. Total Number of Copies (Net press run)		36. Total Number of Copies (Net press run)	
37. Total Number of Copies (Net press run)		38. Total Number of Copies (Net press run)	
39. Total Number of Copies (Net press run)		40. Total Number of Copies (Net press run)	
41. Total Number of Copies (Net press run)		42. Total Number of Copies (Net press run)	
43. Total Number of Copies (Net press run)		44. Total Number of Copies (Net press run)	
45. Total Number of Copies (Net press run)		46. Total Number of Copies (Net press run)	
47. Total Number of Copies (Net press run)		48. Total Number of Copies (Net press run)	
49. Total Number of Copies (Net press run)		50. Total Number of Copies (Net press run)	
51. Total Number of Copies (Net press run)		52. Total Number of Copies (Net press run)	
53. Total Number of Copies (Net press run)		54. Total Number of Copies (Net press run)	
55. Total Number of Copies (Net press run)		56. Total Number of Copies (Net press run)	
57. Total Number of Copies (Net press run)		58. Total Number of Copies (Net press run)	
59. Total Number of Copies (Net press run)		60. Total Number of Copies (Net press run)	
61. Total Number of Copies (Net press run)		62. Total Number of Copies (Net press run)	
63. Total Number of Copies (Net press run)		64. Total Number of Copies (Net press run)	
65. Total Number of Copies (Net press run)		66. Total Number of Copies (Net press run)	
67. Total Number of Copies (Net press run)		68. Total Number of Copies (Net press run)	
69. Total Number of Copies (Net press run)		70. Total Number of Copies (Net press run)	
71. Total Number of Copies (Net press run)		72. Total Number of Copies (Net press run)	
73. Total Number of Copies (Net press run)		74. Total Number of Copies (Net press run)	
75. Total Number of Copies (Net press run)		76. Total Number of Copies (Net press run)	
77. Total Number of Copies (Net press run)		78. Total Number of Copies (Net press run)	
79. Total Number of Copies (Net press run)		80. Total Number of Copies (Net press run)	
81. Total Number of Copies (Net press run)		82. Total Number of Copies (Net press run)	
83. Total Number of Copies (Net press run)		84. Total Number of Copies (Net press run)	
85. Total Number of Copies (Net press run)		86. Total Number of Copies (Net press run)	
87. Total Number of Copies (Net press run)		88. Total Number of Copies (Net press run)	
89. Total Number of Copies (Net press run)		90. Total Number of Copies (Net press run)	
91. Total Number of Copies (Net press run)		92. Total Number of Copies (Net press run)	
93. Total Number of Copies (Net press run)		94. Total Number of Copies (Net press run)	
95. Total Number of Copies (Net press run)		96. Total Number of Copies (Net press run)	
97. Total Number of Copies (Net press run)		98. Total Number of Copies (Net press run)	
99. Total Number of Copies (Net press run)		100. Total Number of Copies (Net press run)	

Kits	Price	Qty	Total
PIC-1 (encoder)	\$65.00		
CompactFlash Card Adapter	\$59.00		
Motorola DVM5602 Interface	\$150.00		
APRS T-233 Weather Station	\$134.00		
TAC-2 (Totally Accurate Clock)	\$139.00		
Differential GPS (Member Price)	\$179.00		
GAS (DVM) Accessory Squibb	\$68.00		
TAPR 9600 bps Modem	\$80.00		
Bit Regenerator	\$10.00		
Clock Option	\$5.00		
PK-232 Modem Discontinues	\$20.00		
PK-232RSX Installation Kit	\$20.00		
XR2211 DCD Mod.	\$20.00		
State Machine DCD Mod.	\$20.00		
State Machine DCD w/Bit Clock	\$24.00		
<b>Firmware</b>			
T2K RAM w/ TNC-2 update base	\$20.00		
TNC-2 1.1.9 w/RSS EPROM	\$15.00		
1.1.9 Command Booklet (only)	\$8.00		
TNC-2 WAVED EPROM	\$12.00		
TNC-1 WAVED EPROM	\$12.00		
TNC-2 KISS EPROM	\$12.00		
TNC-1 KISS EPROM	\$12.00		
PK-87 WAVED EPROM	\$12.00		
TrackBox	\$15.00		
<b>Publications</b>			
ARRL/TAPR DCC 17-19/98-2000 CD	\$56.00		
ARRL/TAPR DCC 17-19/98-2000 CD	\$33.00		
ARRL/TAPR DCC 11-16/92-97 CD	\$33.00		
ARRL/TAPR DCC 1-10/91-94 CD	\$33.00		
TAPR Speed Spectrum Update	\$16.00		
TAPR Software Library	\$20.00		
1997/1998 TAPR CD-ROM	\$18.00		
Wireless Digital Communications	\$59.99		
Furber Radio: What? Why? How?	\$12.00		
BBS System Guide	\$9.00		
TAPR's 94 Annual Proceedings	\$7.00		
TAPR's 95 Annual Proceedings	\$7.00		
PSR Ser Vol 1 (81 - 817 - 82 - 93)	\$20.00		
PSR Ser Vol 2 (83 - 836 - 86 - 93)	\$20.00		
PSR Ser Vol 3 (87 - 852 - 90 - 93)	\$20.00		
PSR Ser Vol 4 (83 - 868 - 94 - 97)	\$15.00		
ARRL/TAPR 2000 DCC	\$15.00		
ARRL/TAPR 1999 DCC	\$15.00		
<b>Other</b>			
TAPR 1 Ltr. Coffee Mug w/sign	\$11.00		
TAPR Dudge	\$18.00		
TAPR Shirt - 4 sizes			
<b>GPS</b>			
TAC-12 Software Registration	\$55.00		
Garmin GPS-25	\$150.00		
Garmin GPS-20/25 Interface/Power Kit	\$40.00		
Garmin GPS-20/GPS-25 Data Cable	\$15.00		
Garmin GA-27 GPS Antenna	\$75.00		
Oncore UT+ GPS	\$213.00		
Oncore VP Interface/Power Kit	\$40.00		
Oncore GT+ GPS	\$189.00		
Motorola Antenna 97	\$65.00		
MCX Hi-Ang Connector w/loop pigtail	\$15.00		

Kit Code	Description
16	
16	A FlashCard is not included in the kit
16	<a href="http://www.tapr.org/apr/faq/faq02.htm">http://www.tapr.org/apr/faq/faq02.htm</a>
16	
16	Requires a GPS to operate
16	Requires a GPS to operate
8	As with the DVM DGT
8	
1	used for regenerative receiver operation
1	used for regenerative receiver operation
1	simplified connection of external modem
2	for installation of 9600 modem in PK-232RSX
2	
2	for KISS receiver TNC w/ bit clock or DCD w/ clock
2	
2	
-1	includes 1, 1/9 Command Booklet (below)
2	full TNC-2 command set for 1, 1, 9
2	8 connect versions for ARRL/DCC stored
4	CD w/ 98 and 2000 Proceedings
4	CD only
4	CD with available Proceedings
4	CD with available Proceedings
10	200+ pages on ARS Speed Spectrum Theory
4	152 pages, 680 Steps of Audio - or from our pages
4	2 CDs Set
26	200+ pages w/sign by Tom McElmurry, H11C7
3	170 pages TAPR's Packet Radio Book
4	90 pages by Barry Burman, W3ABZ
4	Papers from the Annual Meeting (Tucson)
4	Papers from the Annual Meeting (London)
16	
16	
16	
16	
8	2000 DCC Details, FL
8	1999 DCC Proceedings Pamphlet, AZ
4	Logo in black and microwave safe and
0	include Home and Call for badge
	<a href="http://www.tapr.org/apr/faq/faq04.htm">http://www.tapr.org/apr/faq/faq04.htm</a>
11	
28	(Kit code included)
4	
2	No Discount
3	max connector, may need another antenna
21	
3	
28	
8	See introduction, may require
2	No Discount

Subtotal:  Added Total Kit Codes

All prices subject to change without notice and are payable in U.S. funds. Members receive 10% off on Kits and Publications. Please allow six to eight weeks for your order to be shipped. For specific information on kits, see Product Description flyer.



**Tucson Amateur Packet Radio**  
 8917-309 E. Tanque Verde Rd #357  
 Tucson, Arizona • 85749-9399  
 Office: (940) 383-0000 • Fax: (940) 566-2544  
 Internet: TAPR@TAPR.ORG • www.tapr.org  
 Non-Profit Research and Development Corporation

**January 2001**

www.tapr.org • ftp.tapr.org • tapr@tapr.org  
 Office Hours: Tue-Fri 9am-12pm, 3pm-5pm CT

Membership	Price	Number of Years	Total
United States	\$20.00		
Canada/Mexico	\$20.00		
International	\$25.00		

New Member       Renewal

SubTotal

**Membership 10% Discount**  
 Except where noted Member #: \_\_\_\_\_ (Place new if joining)

**Total Sales (Subtotal minus discount)**

**Texas Residents (7.75% tax)**

**Membership (New or Renewal)**

**Shipping and Handling**  
 For Total Kit Codes Between

1 - 7	8 - 15	16 - 27	28 - 55
Add \$5	Add \$6	Add \$7	Add \$8

Kit Codes above 55 or International orders must contact TAPR for amount.

**TOTAL Order Amount**

Charge my credit card (check one)  
 VISA     MasterCard

Exp. Date: \_\_\_\_\_

Signature or Print: \_\_\_\_\_

Home/Cell: \_\_\_\_\_

Street Address: \_\_\_\_\_

City/State/Zip: \_\_\_\_\_

Country: \_\_\_\_\_ Phone Number: \_\_\_\_\_

Internet E-mail: \_\_\_\_\_

