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In This Issue...

President's Report

I would like to start off this issue by congratulating Lyle Johnson, WA7GXD, on the article in *QST* concerning the Deviation Meter. Excellent article, Lyle! TAPR also congratulates all the participants in the latest satellite launches. The new data satellites further enhance digital communications and make Amateur radio stronger. Way to go!

Speaking about satellites, the TrackBox sales have been brisk since the first of August. The Board of Directors has approved to do another run of 120 kits to meet the continued demand. This will be the LAST run of this kit, since the A/D chip is no longer in production. We hope that with the launches of the new satellites, that additional new folks will be needing Trackboxes for their new stations. Also, buy your PSK kit now - the last few are available and we won't be carrying them after these are sold.

On an office note, Heather submitted her resignation as TAPR office manager to the Board of Directors. It was with sadness that the Board of Directors has accepted her resignation, but Heather wanted to move on to new areas of interest. Heather will be helping out during the upcoming office change and we hope that she will continue to be around in some position in the future. See the article on the upcoming office change for more details.

Next year will be an active one for TAPR. You should begin to mark your calendars now to attend the various things we will be doing. The first is the annual meeting in March (5th and 6th) in Tucson, Az. There will be the standard Saturday presentations, but we will be hosting a discussion/policy group Saturday evening to talk about what TAPR should be doing for future projects. It is the aim of the board to develop long-range development goals and then issue RFPs (Request For Proposal) based on these. There will be more on this as we formulate the plan further. Sunday will see a seminar, hopefully of the same quality that Jon Bloom presented last year on DSP (Digital Signal Processing). A question I would like to ask is "Should TAPR move its annual meeting from year to year ?" Maybe have it in Chicago, St Louis, Dallas, or San Diego in 1995? A number of the members have stated that rotating the annual meeting between each coast and the central US would help bring TAPR to more of its members. Please let me know what you think about this.

TAPR will be doing a lot more at Dayton this next year. We will be hosting a regional networking forum one of the evenings at Dayton in order to bring together regional network groups for information sharing. We also hope to hold a BBS discussion/policy meeting one evening. To further distribute TAPR information at the regional level, board members will be attending local conventions throughout the US to put forth the TAPR banner. Dates for these conventions will be publicized

Look for TAPR at these Upcoming Events

February 5-6	Miami Hamboree
February 18-20	Orlando Hamcation
March 4-6	TAPR Annual Meeting and Conference

as soon as we have them set. We hope to get local TAPR members to help in the efforts. We have lost a lot of momentum in the last few years. As one Amateur stated at a recent convention 'I didn't think TAPR was around anymore.' Well, it is, and we better start telling people again what we do and what we are about. If you need TAPR information to distribute at conventions and club meetings, just contact the office. It is also our intention to be more involved with the ARRL Digital Conference in the future. We have already requested to host the conference in 1995.

In another direction, to increase TAPR's visibility and help information dissemination, we are beginning to run classifieds in several Amateur Magazines. Keep an eye out for them. They have good offers for new members. Find them and then tell a non-TAPR member where to look.

On the *PSR* front, we continue to look for folks that want to write about what they are experimenting with, organizing, or doing with packet radio or other digital modes. So we are initiating an incentive system for publications — for every ten pages of articles submitted and accepted for publication by TAPR (published) we will increase your membership one year. So publish and you can get your membership/*PSR* free and help increase the quality of articles for everyone else. What we are looking for are articles on implementations (network, software, radios, hardware) and information explaining how things work (modems, BBS forwarding, etc). Articles should be sent to the editor of the *PSR*. Have a go at writing — it doesn't have to be perfect, that's what the editor is for, he is responsible for catching all the spelling/grammar mistakes (that your word processor misses). The advantages of getting published is that you get 1) folks knowing what your part of the world is doing and 2) possibly finding someone doing the same thing and wanting to work on your area of interest.

Now jumping to world affairs, earlier this year a fire at a resin plant in Japan struck and crippled the world supply of the needed chip material. Although world production is supposed to return to normal the first of 1994, the result has been that the costs of chips have doubled and tripled and the order time has shifted from a week or so up to 12 weeks now on some parts. This put TAPR in the position of not being able to ship some kits immediately. At the start of the year we began to implement a "just-in-time" philosophy on parts for kits — which then came to haunt us with the above disaster. The good news is that things are almost back to normal as far as parts for kits are concerned and we are continuing to define the process. We hope this has not inconvenienced any members and we can only try to keep ahead of events beyond our control. Kit inventory is now back to normal and we hope for no problems like this in the future.

Let me touch base on current projects. Paul Newland continues his development of PCON (see issue #51), the DSP-93 is progressing (see later in this issue for details of the design), and the LAPA proposed standard (i.e. future AX.25 version 2.1) is being reviewed by a group within TAPR. Bill Beech, NJ7P, Douglas Nielsen, N7LEM, and Jack Taylor, N7OO, have put in many months of work on the standard and we hope to move it along to the ARRL Futures Committee as rapidly as possible. These three projects are keeping just a few folks busy.

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That about wraps it up for this quarter. I hope everyone will have a pleasant upcoming holiday period. During the holiday break (from school for me), I will be putting in time at Tucson and then at the new office completing the change in office locations. There is a lot to be done in three weeks. During the time at the old office with Heather and the new one with Dorothy, I will begin to put into words the future direction of TAPR that the board and I have been discussing and what we hope will be a future that leads the organization into as much success as the last ten years has seen.

Cheers - Greg

Wanted: MetCon Users with units in the field!

TAPR is developing a publication on "Implementing MetCon - Examples and Hints." We need to find MetCon owners who have implemented their MetCon and would like to share what they have implemented and designed. We are looking for everything from small to giant setups. Submissions will be used in the MetCon publication and in upcoming articles on the MetCon in various Amateur magazines. Authors will be given full credit on their implementation and receive a discount coupon for future TAPR purchases.

There has been a real need for a publication on suggestions for using and implementing MetCon. A lot of Amateurs who would like to purchase the unit have two basic statements: 1) I am not sure how I would use it, and 2) I am not sure if I could wire it up for something. One thing we hope the new publication will do is help Amateurs become more involved with building and then integrating their MetCon unit to their project — something that not all Amateurs can do from scratch. We want to be able to share the experience and wealth of knowledge of those successful with implementing their kit with those that want to try. Nothing is too trivial.

Send documented examples to the TAPR office, Attention: MetCon Publication.

Office Move

During the Summer, Heather submitted her resignation as TAPR office manager. There are many reasons for this request, but the basic ones are the fact that Heather has kept the TAPR office going for many years now and wants a change and she wants to spend more time with Lyle which she has trouble doing with the hours she is putting in running the office.

With a change impending, the Board began to think about ways to lessen the impact of the move now and again in the future. We have been extremely fortunate to have Heather doing this function, but it cannot be depended on to have the sales office in the same place year after year. With this in mind several points became important:

1. Future flexibility in office location and office personnel.
2. Continue to provide a strong membership services interface.
3. Improve office efficiency while cutting expenses.

With these in mind, here is what the Board of Directors is doing:

TAPR will change the current P.O. Box to a new P.O. Box in Tucson the first of the year where the mail can be handled and then redirected to the location of the sales office. This will allow the sales office to move from time to time without causing the problem of changing the address in Tucson each time. Since the U.S. Postal Service is kind enough to forward for six months or so, this should not interrupt mail service to the office.

Once the new address becomes stable, we will only have to change phone numbers with each office change. We will continue to operate the main number at the old office for several months stating what the phone number has been changed to. We will announce the new address and phone numbers for the new office location as soon as possible, followed by a mailing to all members and continue to release as widely as possible from then on.

We will be closing the current office on Friday, December 17th. The new office will then open on Tuesday, January 11th. These dates were picked because sales are lowest at this time of the year and our financial year starts in January. This makes for a good time to change. The new office manager will be Dorothy, KA5DWR. Heather will be helping through the first of the year and at the annual meeting to get this transition completed successfully. I speak for all members of the Board in saying that we will miss having Heather's melodious voice answering the phones and her sparkling personality running the office. We all wish Heather the best of luck in her future endeavors.

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 puposes.

TAPR is governed by a 9-member Board of Directors. Each member of the Board serves a three year term; normally there would be three positions to be filled each year. At the 1992 annual Board meeting, the number of directors was changed from fifteen to nine. The number of expiring positions at this time is five. Three of these positions will be filled for a three-year term and two for a one-year term.

Board members are expected to attend the annual Board Meeting, normally held in Tucson in conjunction with the annual TAPR Membership Meeting. They participate in the decision-making process and provide guidance to the officers. They receive no pay and must defray their own expenses to attend meetings. Board members should be prepared to be active in the continuing Board deliberations, which are conducted privately in a special conference section on the TAPR BBS. 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:

Crawford, Jerry K7UPJ	1994*
Davis, Jack WA4EJR	1994*
Hansen, Bob N2GDE	1996
Hauge, Gary N4CHV	1996
Jones, Greg WD5IVD	1994*
Justice, Keith KF7TP	1996
Morrison, Dan KV7B	1994*
Jim Neely, WA5LHS	1995
Nielsen, Bob W6SWE	1994*

Nominations are now open for seats expiring in March 1994 (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 and their calls, telephone,numbers and addresses. 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 15 December 1993.

Ballots will accompany the January 1994 issue of PSR or will be mailed directly to the membership. Results will be announced at the annual TAPR meeting in March 1994.

Valley Forge Convention

August 21st and 22nd saw TAPR at the Valley Forge HamShow in King of Prussia, PA. Bob Hansen, N2GDE, Kathy Hansen, Greg Jones, WD5IVD, and Bob Stricklin, N5BRG worked the TAPR booth. Overall the attendance of the convention was low, but TAPR distributed a good amount of material and sold a number of items. Everyone was happy to meet the local PA area TAPR members who came by and spoke with us. The beginning packet sessions were well attended and resulted in a number of folks joing TAPR as new members.

If you need TAPR information to distribute at conventions and club meetings, just contact the office.

DSP-93: The Joint DSP Program (TAPR/AMSAT)

Bob Stricklin, N5BRG

History

The history of DSP-93 can be traced back to 1991 when development began on the KISS DSP. The KISS DSP was a single board DSP engine designed around the Texas Instruments TMS320C25. The KISS DSP board, as described in an earlier AMSAT publication (1), included the DSP, memory, serial I/O, and a limited audio interface. The KISS DSP was designed as a stand alone box to interface between the computer and radio. In some cases, a TNC was needed to process the HDLC digital data. To simplify the computer interface, a monitor routine (DSP BIOS) was developed which included functions to download DSP programs from a computer, view and change both program memory, data memory, and DSP registers. To make software development possible, work was undertaken with Thomas Anderson of Speech Technology in Issaquah, Washington to produce a TMS320C25 assembly table for his assembler. The result was an inexpensive assembler for the TMS320C25-based DSP chip.

Several Amateurs obtained and built the KISS DSP board and placed them in operation. Frank Perkins, WB5IPM, has developed DSP code for the following applications; 1200 Baud FSK, 1200 Baud PSK, SSTV, WEFAX, and APT. Frank has been using the KISS DSP board for satellite activity and development for over a year.

The KISS DSP served as an excellent initial platform to develop and understand the realities of developing DSP software and hardware for Amateur applications. We learned many things about applying DSP to Amateur radio applications during the KISS DSP project. Areas which needed work were the radio interface circuitry and understanding how to match the hardware with the particular application at hand. A single 'do all' DSP box is not a practical solution for all Amateur DSP applications. It is not "Only Software." It is a combination of selecting the best hardware for the particular application and developing the software around the selected hardware. Since most Amateurs are looking for a cost effective solution, you can sacrifice some of the capability and provide them as future additions.

DSP-93

Based on these lessons, DSP-93 has been designed in a modular fashion with multiple four-layer boards which include the interconnecting bus structure. The boards include a DSP engine board, a radio and computer interface board, a second high speed radio interface board, and a high speed network interface board. Any of these boards can be replaced with a future board designed for any number of unique applications. It's sort of like adding a new application card to a PC without redesigning the complete PC.

The first board (DSP Engine) contains the TMS320C25 DSP, 64K by 16 bits of program and data memory, the clock circuitry and some programmable array logic (PALS) for system I/O. All the DSP lines are connected to the backplane bus. This was intended to make it easier to add additional features on additional DSP-93 boards. The floating input lines all have 100K pull-up resistors. The clock circuit for driving the DSP is also included on the DSP Engine board. Since slower EPROMs are used to boot the system, the clock is designed to shift between half the maximum rate and full speed. Clock shifts are software controlled and will be transparent to the application. The target clock speed is 40 MHz; however, we have demonstrated that 26 MHz is adequate for most Amateur applications. Additional testing of the Beta boards will be required to establish the final clock rate.

Board two (Radio Interface Board) contains two eight pin mini-DIN connectors for the radio interface. Incoming radio signals pass through a voltage divider to establish the initial levels, then through an eight channel multiplex chip. The multiplex chip will feed the single A/D input from either of the radio inputs or one of the six auxiliary inputs. Before reaching the A/D, the signal is conditioned by an OP-AMP whose gain is software selectable. G ain options include; 1X, 2X, 5X, 10X, 20X, 100X, 1000X and a comparator mode with ground being the reference voltage. Once again this is all software controlled and it should make for some nice adaptive signal conditioning algorithms.

The Texas Instruments TLC32047 Analog I/O chip is included on board two. This chip samples and updates at a rate of 45K operations per second and it includes aliasing filters. The chip communicates with the DSP using a 5 MHz serial interface. The 5 MHz interface is routed through a selection PAL to allow the user to disable this serial device in favor of another. It is anticipated that this AI/O chip will be fast enough for most of the current Amateur modes.

Board three (High Speed Radio Interface) is a second radio interface board with higher speed analog I/O chips. Its functionality is just like board two, except that it contains the Burr-Brown DSP101 Analog to Digital converter (used for input data) and the Burr-Brown DSP201 Digital to Analog converter (used for output). The A/D chip is capable of 200K samples per second with eighteen bits of resolution and the D/A chip can attain 300K updates per second with eighteen bits accuracy. Neither of the Burr-Brown chips includes a filter, so two EXAR XR1015 filters were included which are capable of operation up to 200KHz. The clocking signals for all these chips are individually controlled and selectable through software. Clocking rates are established by loading an 8-bit divisor to apply to a 20MHz reference clock. Additional division can also be attained in PAL chips used for interface.

Board four (Network Interface) is intended to support higher speed modes like HRPT which require moving large amounts of data to the computer faster than a serial port can handle. A National Semiconductor ST-NIC chip was selected for the task. The ST-NIC is working in the eight-bit mode. An 8K SRAM buffer is included for network packets. The DSP will be able to read and write to all the registers of the ST-NIC. This high speed data interface will be an advantage when dealing with video applications. The ability to utilize the

card in a network environment will be limited. It is intended to work only at a netbios level with a very simple structured DSP protocol. A NETBIOS interface will require dedicated software in the computer for communications. The success of the network board will depend on the available DSP cycles leftover between A/D samples after all modem tasks are completed. This will also be influenced by the final DSP clock speed. The answers to these questions will have to wait until more software and hardware development work is completed. It may ultimately be possible to use some of the networking capabilities of the ST-NIC to create a driver for a DSP modem. It will sort-of extend your network to the radio world. We probably have enough possibilities here to keep a lot of folks busy for a long time.

Current Development

At this point, 10 alpha boards have been produced utilizing funding provided by The Joint DSP Program, co-funded by TAPR and AMSAT. Volunteers, most of which worked with the KISS DSP, have been identified to build the 10 alpha boards and debug the design. When the time is right (Winter 93), beta kits will be produced and made available to testers. After these are assembled and the feedback is collected and evaluated, a larger production run will be made. If you would like to take part in the beta build, applications are being accepted (see article on Beta- testers). You may contact TAPR at 602-749-9479 to obtain one of the applications. A selection process will be used to insure we can get the best possible feedback and a fast turnaround on the beta build.

DSP-93 will eventually be supplied as a kit (date to be determined). The initial offering will only include boards one (DSP Engine) and two (Radio Interface). A low cost assembler will be made available for code development. To develop code for this board you must have good reference material. You can find numerous books on DSP algorithms and developing DSP code. The manufacturer's data sheets and books for the complex chips will also be good reference material. All the details needed to write DSP code will be supplied with the kits.

For those not wanting to build a kit, there are several preassembled DSP units on the market today. Ads for these units can be found in various Amateur publications.

To make this project a success, more people are needed who want to learn about developing DSP applications, networking, and converting from the real linear world to the digital world. Ideally, everyone taking the challenge will select a particular idea and become so focused in the application that they become the expert. Some of the areas for development might include: new modulation techniques, speech synthesis, filters, spectrum analyzers, and many more applications you will think of. If you choose to work on the hardware aspects of this project, the modular approach should allow you to convert to other DSP chips or Analog I/O chips or to add additional capability.

Beta-Test Request

If you would like to participate in the TAPR/AMSAT Joint DSP Project Beta-Test, please fill out the following questions in as much depth as possible. Since there will be a limited number of Beta units available, this information will be used to select the best possible group for testing the units.

The purpose of beta-testing is to make sure that the kit documentation is correct, to detect hardware problems not found during the alpha-test, and to verify that the software is functioning adequately in a wider range of applications. Beta-test units will be made available to those selected at a break-even cost. Beta-testers selected will be required to sign a Non-Disclosure Agreement concerning the project. Last but not least, beta-testers will be responsible for communicating their reactions back to the DSP-93 team during the beta-testing period.

Submit the following information to the TAPR office, Attention: DSP Beta-Test Request

Date, Name, Call, Address, City, State, Zip, Home Phone, Work Phone, Fax Phone, Internet Address, Other E-Mail Address (with mail access to Internet).

1) Please describe in a few paragraphs your reasons for wanting to participate in the beta-test.

2) Do you work for, or consult for, any Amateur or commercial manufacturer of packet radio or digital communications equipment ? If so, please explain.

3) Please describe your background in software (programming experience) and hardware (design or technical support).

Equipment Options for Medium to High-Speed Packet

Compiled by Barry McLarnon, VE3JF

Last update: 2 July 1993

The purpose of the following is to summarize the hardware options available for constructing medium- to high-speed packet links. Thus far, only 9.6, 19.2, and 56 kbps are covered. This material is intended to be a useful reference, but I make no claims as to its accuracy or completeness. Many details concerning model numbers and prices are missing, and I have very little information concerning equipment sources outside North America. If you have corrections, or suggestions on additional information to include in this survey, please send them to bm@hydra.carleton.ca (or ve3jf@ve3jf.#eon.on.can.noam).

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Note: unless otherwise noted, prices given are in $US.

Equipment for 9600 bps

9600 bps Modems

The K9NG modem was available for a number of years as a kit from TAPR. It set the "standard" for 9600 bps packet operation, but it has now been replaced by the G3RUH and new TAPR designs. Among the improvements provided by the newer designs is full-duplex capability. Even when full-duplex is not needed on the air, this

is a great convenience for doing loopback testing of the modem. If you still have a K9NG modem lying around, though, don't hesitate to try it!

The G3RUH modem is available from several sources:

PacComm MC-NB96 internal modem card ($109) - fits on disconnect header of most TNCs.

PacComm EM-NB96 external modem ($175) - standalone version of above.

Kantronics DE9600 modem card, similar to the PacComm MC-NB96.

MFJ MFJ-9600 9600 bps modem card ($110), similar to the others.

The new 9600 bps TAPR modem kit ($70). The new design has all of the features of the G3RUH, plus a few enhancements. It is attractive for repeater use, since it includes provision on the board for bit regeneration/FIFO buffering ($10 extra for the parts). The first revision of the board in 1992 had a few problems, and some mods were needed for best performance. A new revision which incorporates the fixes became available in early 1993.

The G3RUH and TAPR modems can plug directly into a TNC modem disconnect header as a daughterboard, or be connected externally via a ribbon cable.

DRSI DPK-9600 ($250). This is a G3RUH-compatible modem and TNC-2 clone (10 MHz clock) housed in one box.

Data Interfaces for 9600 bps

For 9600 bps, the usual interface is a TNC. If you don't already have a TNC, it's worth considering a PC bus interface card like the PI or the PackeTwin. They are a better investment since they will not become obsolete if you upgrade to higher speeds than 9600. In fact, many people have reported results with TNCs that were much less than theoretical maximums, even at 9600 bps. The faster the TNC clock rate the better: 4.9MHz should be considered an absolute minimum.

Ottawa PI board ($120 US, $140 CDN). It provides a DMA port which handles 56 kbps with ease, even with a 4.77 MHz XT-class machine. All you need to add is the cable to the modem. The main limitation of the board is that it does not support full-duplex operation, but full-duplex operation is rare (especially amongst end users). The PI also supports a low-speed port (you provide the modem and radio). The board can be used with any version of KA9Q NOS.

Gracilis TWIN-1E PackeTwin card ($225). Like the PI, it provides a DMA port for the 56 kbps modem and an interrupt-driven port for lower-speed modems. The DMA port supports full-duplex operation. The Kantronics 9600 bps modem can be piggybacked on the card.

DRSI PCPA Type 1296 ($290). An interrupt-driven PC-plugin card with onboard 9600 bps and 1200 bps modems.

Radios for 9600 bps

A standard NBFM radio is typically used. To interface to the modem, the radio must have a direct FSK modulator, discriminator output, an IF with sufficient bandwidth and reasonable phase characteristics, and fast t/r switching. Some radios are usable with just a few modifications to bring out the required signals, others may need more extensive mods such as adding a varactor FM modulator, and still others are almost completely unusable due to their IF characteristics or slow t/r switching. There are a few radios designed specifically for digital service which require no mods:

2m

DRSI offers a "matched set" ($550) consisting of their DPK-9600 TNC/modem and a modified Alinco DR-1200T (20W, synthesized).

70cm

Tekk data radio ($190), 2W output, one channel, crystal controlled (430-450 MHz). Available from Gracilis and other sources. Gracilis has a package (TWIN-96E) consisting of the PackeTwin card, 9600 bps modem, and Tekk radio which lists at $520.

PacComm has two packages which contain the Tekk:

PacComm DT-NB96 ($369): Tekk radio and 9600 bps modem housed in one box.

PacComm IPR-NB96 ($499): Tekk radio, modem, and Tiny-2 MK-2 TNC housed in one box.

Kantronics D4-10 ($359), 10W output, two channel, crystal controlled (430-450 MHz). Can go to at least 19.2 kbps.

A large number of amateur VHF and UHF transceivers have been successfully used for 9600 bps work. Many commercial FM radios are also suitable; ironically, the IF filters in these radios are typically 'better' (narrower bandwidth, steeper skirts) than in amateur-grade equipment, which leads to inferior performance at 9600 bps (on the other hand, they also tend to have superior intermod immunity compared to amateur rigs). The IF stages of most receivers can be broadbanded successfully, but the degree of difficulty and expense involved varies considerably.

A good source of information on radio interfacing and other topics related to 9600 bps operation is the "9600 Baud Packet Handbook" by Mike Curtis, WD6EHR. Hard copies are distributed with the TAPR modem, and it can also be found in electronic form on some BBS's.

Summary: 9600 bps

The cost of getting something working at 9600 bps is highly variable. If you already had a TNC and a suitable radio plus antenna, it could be as little as $70 or so (TAPR modem). On the other hand, you can get a "plug 'n play" package from Gracilis, consisting of a PackeTwin interface card, DE9600 modem (piggybacks on the PackeTwin), and Tekk radio, for about $500 - just add an antenna. You should seriously question spending this kind of money to get 9600 bps, when you could put together a 56 kbps setup for not much more money (but, admittedly, considerably more effort!).

Equipment for 19.2 kbps

Until recently, operation at 19.2 kbps had not received much attention. A major reason for this is that binary FSK at 19.2 kbps cannot be accommodated by the IF stages of NBFM receivers, nor is it compatible with the 20 or 25 kHz channel spacing used for FM in the amateur VHF/UHF bands. On the other hand, it makes relatively

poor use of the 100 kHz channels typically allocated for 'wideband' digital modes. However, interest in 19.2 kbps operation has been spurred by the appearance of the Kantronics D4-10 radio. Since it contains a varactor modulator, plus a data slicer following the discriminator, it can be operated in 'raw FSK' mode at 19.2 kbps without additional modem hardware. All that is needed in addition to the radio is the computer interface. A 'souped-up' TNC might work fairly well, but one of the PC DMA interface boards (or maybe a DataEngine) would be better. Running 'modemless' FSK entails some loss of performance, most notably from the lack of data scrambling, which results in more jitter in the recovered clock signal and thus higher bit error rates.

Kantronics also offers a 19.2 kbps modem, similar to the DE9600. The performance difference between the 'barebones' D4-10 radios and that which you could realize with the more sophisticated modem has not, to my knowledge, been quantified. The GRAPES modem (see below) could also be run at 19.2 kbps, but it would not be compatible with the Kantronics equipment (and why would you want to throttle back a modem that can do 56 kbps and more, to only 19.2?).

Some experiences with using the D4-10's at 19.2 kbps, using Ottawa PI cards and DataEngines as interfaces, appear in an article by John Ackermann AG9V in the 11th ARRL Computer Networking Conference Proceedings.

Equipment for 56 kbps

56 kbps Modem

GRAPES (WA4DSY) modem, $250 in kit form. You also need to provide a box for it, plus a few interconnecting cables and connectors. It requires +/-5V power (about 0.5A @ +5V, 0.1A @ -5V). This is an RF modem with input and output (about 1 mW) in the 28-30 MHz band, designed for use in the bands above 220 MHz (occupied bandwidth is about 70 kHz at 56 kbps), using standard receive and transmit converters. The receive and transmit portions of the modem are separately crystal-controlled, and it can run full-duplex. It is not limited to 56 kbps - with suitable modifications, it can be made to work at 128 kbps or more.

Data Interface for 56 kbps

Ottawa PI card ($120)

Gracilis PackeTwin card ($225)

Both of these cards (see descriptions above) will handle 56 kbps with ease.

Kantronics Data Engine (need price info). This is essentially a higher-speed TNC with two HDLC ports that can reportedly run at 56 kbps, and an RS-232 port that can run at up to 19.2 kbps. The standard firmware is G8BPQ, but there is now also a port of JNOS (JNOS40) by WG7J available. The DE appears to be more useful as a small standalone packet switch then as an interface for end users.

Gracilis PackeTen (~$1500?). This is a full-blown packet switch that runs a custom version of KA9Q NOS. It is available in both standalone and PC bus versions. If you need more than two high-speed ports (more than one, if you need full-duplex), then this is really the only choice.

RF Equipment for 56 kbps

The RF equipment required depends on whether the links are half- or full-duplex. There are three basic configurations in use:

(1) Half-duplex point-to-point links

An example is the Georgia backbone network. The usual RF equipment is a Microwave Modules (220, 430 MHz) or Sinclabs (220 MHz) transverter.

(2) Full-duplex point-to-point links

Full duplex operation is significantly more complicated, but it is also highly desirable if you want to maximize the throughput of a backbone link. The GRAPES modem is inherently full-duplex, so it is only necessary to provide separate RF up- and down-converters. The two channels may be in-band or cross-band, using either separate antennas or duplexers. The only full-duplex point-to-point link I'm aware of is in Chicago - it uses PackeTen switches and operates in-band in the 70 cm band.

(3) Multiple-access networks with full-duplex repeater

In this case, an in-band or cross-band 56 kbps repeater provides hidden transmitter-free access to a channel (or rather, a pair of channels) by multiple 56 kbps stations. This might just be a LAN for the power users, but it also is an attractive means of linking a number of network nodes together, with less complexity than multiple point-to-point links (see the 10th ARRL Computer Networking Conference proceedings for more details). As in the preceding case, separate receive and transmit converters are used, usually with separate antennas (in principle, a transverter with "split" frequency operation could be used, but such things are hard to come by). The stations in this network do not require full-duplex computer interfaces, but since the RF portions have full-duplex capability, it allows smaller txdelays to be used than in the half-duplex case. It also allows users to observe the quality of their signals coming back from the repeater.

The first 56 kbps full-duplex repeater went on the air in Ottawa in January 1990. The repeater is cross-band (220.55 MHz in, 433.55 MHz out), so users must up-convert the modem's 28-30 MHz IF output to 220 MHz, and down-convert 432 MHz to the 28-30 MHz IF input.

220 MHz

Transverters and up-converters:

Sinclabs ST220-28 transverter ($329 CDN), 15W output. Sinclabs has recently withdrawn from this business, but transverters may still be available from Bob Morton, VE3BFM (Maple Leaf Communications).

Microwave Modules MMT220/28S transverter, 10W output. Not readily available new, but watch for used ones on the market.

SSB Electronic TV 28-220/01 transverter ($380), 100 mW output. These units have no T/R switching, so that would have to be added externally for single-channel half-duplex operation. On the other hand, there are separate local oscillators provided for the receive and transmit converters, so this looks like a good choice for in-band full-duplex or half-duplex split operation.

Hamtronics XV4 transmit converter (kit, $79), 0.5 - 1W output. The cheapest alternative, and the power level is adequate if you aren't too far from the repeater and have a reasonable transmitting antenna. But you do need to find someone with a spectrum analyzer to get it tuned up properly, and some people have had problems taming this unit.

Down-converters:

Microwave Modules MMc220 (price/availability unknown), 2.8 dB NF.

Advanced Receiver Research (model no., other details unknown). This unit is in the $100 range and of high quality, but it really needs a front-end preamp. We use one of these converters on the Ottawa 56kb repeater, along with an ARR preamp. ARR may be no longer producing the converters.

Antennas

You might get by with omni antennas, but multipath can cause poor performance even when signal levels are high. Small yagis provide more margin and help discriminate against multipath. A typical example is the Cushcraft A220-7 7-element yagi (about $50).

430 MHz

Transverters and up-converters

Down East Microwave DEM432 no-tune transverter, 50-100mW output. This is a 3-board set, available in several forms, and there is an optional power amplifier that provides 15W output. The local oscillator board normally has a single oscillator for standard half-duplex operation, but a second oscillator can be added on the board for half-duplex split or full-duplex operation. Some options and prices:

DEM432B assembled and tested unit, including case, $275
DEM432B DUAL as above, but set up for dual frequencies, $300
DEM432K basic kit (no case or connectors), $155
Second LO kit, $8
432PA 15W PA, assembled and tested, $180
432PACK 15W PA complete kit, $135
432PAK 15W PA basic kit (no case, connectors or heat sink), $75
Enclosure to house both DEM432K and 432PA, $25
DEM432-15S complete 15W dual-frequency transverter, $395

Microwave Modules MMT432/28S transverter, 10W output. Not readily available new, but quite a few used ones on the market.

SSB Electronic TV 28-432 transverter ($310), 100mW output. These units have no T/R switching, so that would have to be added externally for single-channel half-duplex operation. On the other hand, there are separate local oscillators provided for the receive and transmit converters, so this looks like a good choice for in-band full-duplex or half-duplex split operation.

Hamtronics XV4 transmit converter (kit, $79), 0.5 - 1W output. The 432 Mhz version of the unit described above.

Down-converters:

Hamtronics ($49/$69/$99 for basic kit/kit with box/wired & tested). Quality of this unit is uncertain.

Microwave Modules MMc435.2 ($115). Current availability unknown.

SSB Electronic K7001-10 ($180). High quality, with a price to match.

There are other sources for units in the $100-$150 range, such as Lunar.

1.2 GHz

Equipment for operation of the GRAPES modem at 1.2 GHz and the other bands above 450 MHz is a problem, due to the scarcity of converters which have input/output at 28 MHz, not to mention reasonable power output.

Transverters and up-converters:

SHF-1240(K) "No-tune" transverter board ($149 kit, $189 assembled, from Down East Microwave): 144 MHz IF (10 mW drive required), 10 mW output. Also required is the separate SHF-LO local oscillator board ($50 kit, less crystal; $85 assembled). A complete transverter (transverter board, LO board, IF PIN diode switch, packaged in a metal box) is available for $265. Note that no RF switching is included, so if you wanted to run half-duplex, a suitable RF T/R switch or a circulator would be needed. NF of the down-converter is in the 4-5 dB range. Due to the 144 MHz IF, a separate 28 MHz to 144 MHz conversion stage would be needed.

SSB Electronic USM-3 transmit converter ($210). 1W out (20 mW in). Requires external LO source (10 mW). Although normally used with 144 MHz IF, it reportedly can be tuned for 28-30 MHz IF input. Housed in a metal box with BNC connectors.

Down-converters:

SSB Electronic UEK-3 receive converter ($200). 2.2 dB NF, 20 dB conversion gain. The nominal LO frequency is 1152 MHz, for conversion of the 1296-1298 range to 144-146 MHz. An LO output port is provided for driving the USM-3 transmit converter. Housed in a metal box with BNC connectors.

Power amplifiers:

Pauldon (kit, $165): 18W out for 1W in.

Down East Microwave 2318PAM ($205): 18W out for 1W in. Also available in kit form.

SSB Electronic PA 2310 ($250): 10W out for 0.5W in (a 20W out version is $300).

Antennas:

Although loop yagis are commonly used at 1.2 GHz ($89 kit, $109 assembled for the 45-element loop yagi from Down East Microwave), a better choice for linking would probably be the Tonna 23-element yagi (about $70).

Other Considerations (applies to all bands):

The receive converters have very broad front ends, and some additional bandpass filtering will often be needed. A single cavity (or helical resonator frontend filter, in the case of separate receive converters) should do the trick in most cases. There is also a design available for a homebrew 28-30 MHz bandpass filter for the modem front end. This might eliminate the need for a front-end filter, but it depends on your receiving environment.

56 kbps Summary

The cost of a 56 kbps station is a bit hard to pin down, given all the variables. As an example, we'll consider a station for the Ottawa 56kb LAN. The modem kit and a PI board will set you back about $370. The rest depends on the choice of rf stuff. The total will vary from about $500 to $800. The "low road" is using the Hamtronics kits and scrounging up things such as boxes for them and the modem, homebrewing the antennas, etc. The "high road" is buying higher-quality assembled and tested gear, such as the Sinclabs transverter and the MM receive converter. If you can find some good used gear, the total should be closer to $650. Getting on 56 kbps is certainly a more challenging project than plug 'n play 9600, but the rewards are greater too.

Sources

Down East Microwave
RR 1, Box 2310
Troy, ME 04987
207-948-3741 Fax: 207-948-5157

DRSI (Digtal Radio Systems Inc)
2065 Range Road
Clearwater, FL 34625
813-461-0204 Fax: 813-447-4369

Gracilis Inc
623 Palace Street
Aurora, IL
708-801-8800 Fax: 708-844-0183
Email: info@gracilis.com

GRAPES Inc.
P.O. Box 871
Alpharetta, GA 30239-0871
Email: dug@kd4nc.atl.ga.us

Kantronics
1202 E. 23rd Street
Lawrence, KS 66046
913-842-7745 Fax: 913-842-2021
BBS: 913-842-4678

Maple Leaf Communications (Bob Morton, VE3BFM)
R.R. 1
Everett, ON, Canada L0M 1J0
705-435-0689

MFJ Enterprises Inc
PO Box 494
Mississippi State, MS 39762
1-800-647-1800 (order) 1-800-647-8324 (tech info) Fax: 601-323-6551

Ottawa Amateur Radio Club
Packet Working Group
P.O. Box 8873
Ottawa, ON, Canada K1G 3J2
Email: bm@hydra.carleton.ca

PacComm Packet Radio Systems Inc
4413 N. Hesperides Street
Tampa, FL 33614-7618
813-874-2980 Fax: 813-872-8696

SSB Electronic USA
124 Cherrywood Drive
Mountaintop, PA 18707
717-868-5643

Hi-Speed Digital Communication in Japan

Ryuji Suzuki, JF7WEX.
Packet Radio User's Group, PRUG

[From the July 5th issue of Packet-Radio Digest, the digest form of the USENET rec.radio.packet newsgroup]

Please allow me to write about our plans to experiment with high-speed digital communication over radio in Japan.

TNC

We have a type of TNC named "TNC-Z," developed by Masaaki Yonezawa (JE1WAZ), using the HD64180S (HITACHI) chip, dedicated to kiss-mode. It can handle up to 2Mbps differential Manchester symbol coding (and NRZ/NRZI) at the radio port. Because it aims to be used for multi-modes of radio, only an external modem is available.

FSK

We have already experimented with 64Kbps at 1200MHz several times. At that time, a pair of IC-1200 are used for full-duplex. (It is hard to make the rig work both TX and RX concurrently.) The modulation was done directly at the VCO of the TX-RIG, (because the PLL is not scrambled, we decided to use that signal) and a small external circuit, using MC-3356P (MOTOROLA), which converts IF of IC-1200 (136MHz) below into 10.7MHz, filter it, and shape detected signal, for demodulation was prepared. The book "High-speed Packet TNC" which describes V.27ter, V.29, 64Kbps FSK, and already distributed PCB at that time for them has published with genny.or.jp, but sorry only Japanaese edition is available.

RF part was further improved to be independent component separately from up-converter. The circuit and PCB, MC-2833P (MOTOROLA) as TX-part, the same 3356P added local oscillator (crystal controlled) and RF amp in as RX, also including PTT(RTS) control and voltage regulator, had developed by me.

No filter was used during the experiments because the digital filter was not made in time. Now, some prototypes have already been built and evaluated. All digital filters have been developed by Shin'ichi Kanno, JN1JDZ. He is selecting from among them and turning it to practical use.

PSK (being planned)

Some kinds of suitable chip, dedicated to demodulate QPSK, are supplied for consumer products. One kind is for NICAM, about 750Kbps. (728Kbps or 768Kbps??) Another is for PCM audio channels of satellite broadcasting, 2.048Mbps. I found chips supplied from TOSHIBA for each use, and from MICRONAS (Finnish company) for NICAM.

A problem still lies in modulating. I know some groups are using a look-up EPROM and D/A, and we know of the existence of various applicable chips, useful for this purpose, from RF MICRO DEVICES.

I think demodulator must be composed cheap and simply, but modulator is in question as to how to construct. In case of using the RF-2802 or 2402, containing 90 degrees hybrid phase splitter and two balanced mixers, it is easy to do so. And the catalog says "Low Cost." I am interested in using them. Anyone used? How much did it cost?

Protocol and software

We simultaneously researched broadcasting-type protocols for scattering USENET compatible news, ampr.net-JA, over radio.

Using Packet Radio in Education

Larry Lucas, N5XRZ

Across the country and around the world teachers who are also Amateur radio operators are exploring the usefulness of packet radio as a communications tool in education. One of these pioneers is Kathy Hootman, N5VKY, a 6th grade science teacher at Sanger Middle School in Sanger, Texas.

Kathy obtained her codeless Technician Class license as a result of taking a special graduate level telecommunications course at the University of North Texas during the Summer of 1991. The course, which emphasized radio-based communications, was taught by Greg Jones (WD5IVD), Mike Maner (WI5H), and Gerald Knezek (KB5EWV). Course material focused on various uses of all modes of Amateur radio communications to support and enhance K-12 educational activities. Material/subject matter necessary to pass the FCC exams required for the No-code Tech. license was also covered in the course. Kathy was one of the students that successfully passed the exams.

Sanger Middle School got their station on the air in the Fall of 1992. During the 1992 school year, Kathy was very active in exploring the operation of a packet station and its usefulness in the classroom. On behalf of her science classes, Kathy sent out packet messages and requests internationally. As a result, she and her classes received responses from many other pioneers who are attempting to utilize packet as a communications tool in their classrooms.

Kathy has compiled a list of over 35 schools/classrooms throughout the world that are using packet radio in various ways to support and enhance classroom activities. Table 1 is an abridged listing of these pioneering schools.

Kathy has also assembled a list of potential classroom applications of packet radio (see Table 2). Although she hasn't had enough time yet to investigate all the potential uses, Kathy does have a few students that are using the pen-pal application. She also has found the class survey application, the career interview use, "ask the expert", and obtaining geographic information from residents of various countries to be beneficial enhancements to curricular activities.

If any readers are also using packet radio in educational activities, we would appreciate hearing from you. We would like to focus on a packet-using teacher in each of our issues. Send information about your packet educational uses and activities to:

Larry Lucas, N5XRZ
TCET
P. O. Box 13857, UNT Station
Denton, TX 76203
Phone: 817-565-4470
FAX: 817-565-4425
E-mail: llucas@tenet.edu
or
llucas@tcet.unt.edu

Any packet using teachers interested in communicating with Kathy's classes are encouraged to contact Kathy, N5VKY:

phone: 817-458-7916
fax: 817-458-5140
packet: N5VKY @
WO5H.#dfw.tx.usa.noam

Table 1: Kathy's list of schools worldwide that are using packet radio

Callsign	Operator	School	City	State or Country	Subjects
KB7GL	Vic	Lakeview Elem.	Kirkland	WA	grades 4 & 5
NR2S	David	High School	St. Lawrence Cnty.	NY	math & comp. sci.
N2RGT	Tim	Pine Valley Central	South Dayton	NY	planning a station
N2LEA	Doug	South Junior High	Newburgh	NY	science
N7XQW	Ron	elem.	Mesa	AZ	grade 4
WB9EZY	Tom	middle	Clinton	WI	grades 5-8
WB4DYU	Al	Royal Palm Elem.	Miami	FL	
N2OQG	Ryan	Jr. High	Medford	NY	radio club
KB6WYU	Owen	elem.	Cerritos	CA	grade 5
N5YMV	Jeff	elem.	Weatherford	TX	grade 4
KA7WXY	Walter	elem.	Kelso	WA	grades 3-5
KB0CUS	Charles	Marlbourough Elem.	Kansas City	MO	
DB0EKS	Uwe	Erich Kaestner School	Bochum	Germany	11-12 year olds
F6GBH	-	-	Colombes	France	tech. ed
ZL1BGB	Ross	middle	Pakuranga	New Zealand	
KI5FY	Dan	Huntsville Middle	Huntsvill	AR	grades6-8
KB5TBQ	Dan	Longfellow Jr. Hi	Enid	OK	tech. ed

Table 2: Some curriculum supporting applications of packet radio

- Pen pals
- Contact space shuttle
- Surveys
- Unit on BIOMES
- Collect weather data
- Packet Geo-Quiz
- Request soil samples
- Chart contacts
- Seed exchange
- Career matching
- Contact Russian space station
- Interviewing experts

12th Annual Digital Communications Conference

Tampa, Florida
September 10-11, 1993
Hosted by: The Tampa Local Area Network (TPALAN)

Although the number of attendants to the conference was down this year, (around 50-60) the quality was good. Following is a brief summary of each paper presented at the conference. The conference began Saturday morning with Jon Bloom, KE3Z, welcoming everyone to the conference. Saturday evening saw an interesting discussion on various BBS issues. *[Watch for a summary of the BBS discussion in a future issue of PSR.]*

The 1993 conference proceedings are available from the ARRL for $12. The ARRL also sells all the past proceedings, which are well worth having if you are new to packet radio.

The following is a short summary of each paper that was presented:

Using Airborne Digital Repeaters in Emergency Communications; Gary Arnold, WB2WPA

Gary discussed experiences with using airborne packet radio to extend their network in Florida in times of emergency. They have had some very interesting experiences and have improved communications between North and South Florida during Hurricane season and other emergency tests. Continued testing is planned for the future.

DSP Implementation of 300- and 1200- baud FSK Packet Demodulators; Jon Bloom, KE3Z

Jon discussed basic DSP theory using examples of implementing the standard 300 and 1200 baud FSK packet demodulators.

Usage of TCP/IP Over ROSE in the Tampa Bay Area; Chuck Hast, KP4DJT/TI3DJT

Chuck explained what the TAMPA Bay area has been doing to get TCP/IP packets over their ROSE network in the area. They have found that they can get TCP/IP to work pretty well over ROSE.

Unique Identification Signals for CCIR 625; Michael Huslig

Michael overviewed one method (CCIR 625) of encoding callsigns into AMTOR. Follow-up revealed that there are several methods being used and that these solutions could possibly lead to significant inconsistency in the methods used by various implementations of AMTOR. These differences could disrupt Amateur communications.

Network Information Services; Brian A. Lantz, KO4KS

Brian talked about the TNOS network information server. He showed various examples of it working and how simple it is to configure and operate. TNOS is a hypertext driver that allows tutorials, help systems, online surveys, and more to be added to NOS.

Low Cost Entry into Packet Radio Using BayCom; Christopher C. Rendenna, KB2BBW

Christopher overviewed how BayCom was designed and operated. He then discussed the positive factors involved with getting folks into packet radio inexpensively.

Improved TNC Interconnections; Donald A. Rotolo, N2IRZ

Donald's presentation showed improved hardware interconnects for TheNet and ROSE using the improved Diode Matrix Board.

Packet Tracker — A Graphical Packet Tracking Program; and

Mail Tracker — A Graphical Mail Tracking Program; Mark Sproul, KB2ICI

Mark showed two new Macintosh-based software programs that allow tracking of packet traffic and mail messages in a graphical format. Both of these programs have some very real potential for discovering problems in network packet and mail message routing. Mark showed some very interesting mail loops that had been occurring in the US that could now be found and possibly fixed.

Notes From The TAPR Office

This will be the last "Notes" that I write from the office!

In July I made the decision that this year would be my last serving you as TAPR's Office Manager. Effective around Christmas time, the TAPR office will be leaving Tucson and moving to Texas where Dorothy and Bill Jones will operate it.

I am not mad or even unhappy. I have sincerely enjoyed serving you as TAPR's official office person since 1989 (and as a volunteer assistant since TAPR's founding in 1981).I will miss you all, as working with you has been a genuine pleasure.

What brought this on you may ask? There are simply some things that I desire to accomplish that working full time does not allow.

I have had the pleasure of working for all of the TAPR presidents, and believe that our present president is doing a marvelous job, and has the energy and vision to lead TAPR into the future.

I am sure there will be a few rough spots as we make this transition. Please be patient and understanding as Dorothy and Bill pick up their new tasks and become familiar with serving the wonderful group of people that you all form.

I will be helping, coaching from the sidelines and generally doing all I can to help make this transition as smooth as possible.

Please join me in welcoming Dorothy and Bill as your new TAPR Office Team!

73,

Heather N7DZU

TrakBox Update

During beta testing of firmware, some version numbers were used that caused confusion for some builders. The TrakBox currently being distributed by TAPR has firmware release 3.00. The sign-on version number is 3.00a dated May 5, 1993. This is the "official" firmware released by JA6FTL who heads the TrakBox Project.

In the most recent kits, a few unexpected problems have surfaced. The first one has to do with U6. It has been determined that this part MUST be a 74LS04. In some of the kits a 74HCU04 or 74HC04 was furnished. This caused two problems. Some builders of the kits used the extra inverters in the part to interface to Yaesu transceivers. The "U" (unbuffered) part caused them a problem. These parts also caused a problem in the area of the A/D converter when used with a non-CMOS CPU so that the TrakBox would not correctly report the antenna position.

Another problem has to do with the BCD switch furnished in the kit. This is a 10-position BCD switch and should turn continuously. It should not have any stops. It has been reported that some of them have an internal stop and only 9 positions. These will not work correctly and should be returned to TAPR requesting a replacement. All of these problems have been corrected in kits currently being shipped and I apologize for any headaches caused by them.

The TrakBox Project has gained a large following and is being supported by some very impressive software packages. Using this software, some users report that they are able to fully automate their satellite stations. I suppose this explains why I still have a difficult time getting into the satellite during the day when most users are away at work.

Jack Davis - WA4EJR @ ko-23 and ko-25 soon I hope.

Backlit TrakBox Display

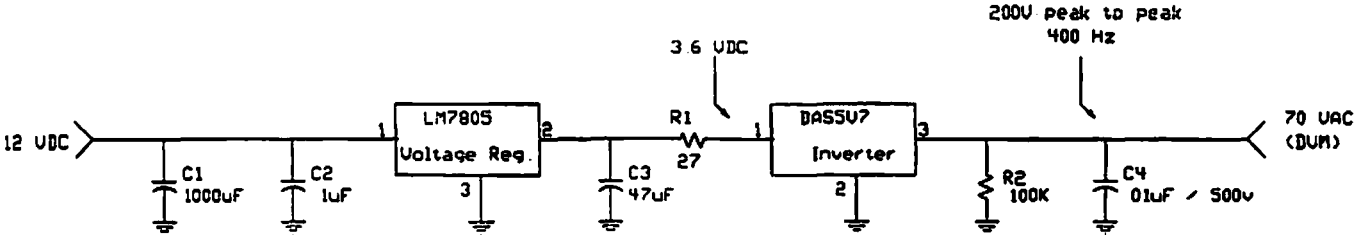
Jim Shepherd, K6OYY

This circuit can be used to implement backlighting on the TrakBox LCD display. It uses a Densitron DAS5V7 inverter module to convert the 5 volts DC to the high voltage AC required. It is important that the interface circuitry include filtering on the output of the inverter since the inverter generates a square wave that creates hash if left unfiltered.

This circuit has been in almost daily use for over a year with no problems. It has been duplicated by N7ASZ, N6EGY, and others with good success. The Densitron DAS5V7 is available from:

Component Marketing Assoc.
16 Technology Drive, Suite 127
Irvine, CA. 92718
714-727-0688

The price for the inverter is about $15.35.



Restrictions Relaxed on Permissible Communications in the Amateur Service

The FCC has amended the amateur service rules in order to allow amateur operators more flexibility to provide communications for public service projects as well as to enhance the value of the amateur service in satisfying personal communications needs.

The international Radio Regulations define the amateur service as a radiocommunication service for the purpose of self- training, intercommunication and technical investigations carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest. Part 97 of the commission's Rules prohibits amateur stations from transmitting any communications the purpose of which is to facilitate the business or commercial affairs of any party, or as an alternative to other authorized radio services.

The amendment would allow the amateur service to expand its public service capabilities and to provide greater flexibility for personal communications. The amendment would allow licensees to use amateur service frequencies to facilitate events such as races and parades, to support educational activities, to provide personal communications such as making appointments and ordering food, to collect data for the National Weather Service, and to provide assistance voluntarily even where there are other authorized radio services available.

The Commission was unable to accommodate the American Radio Relay League's request that the Commission provide a list of anecdotal examples of permitted and prohibited communications. The Commission stated that such a list would necessitate that the FCC intrude upon the day-to-day functioning of the service to a far greater degree than desired. The FCC also said that there would have to be thousands of examples, and declined to devote staff resources to the development and maintenance of such a list.

A New High Speed Terminal Node Controller

Roland Alber,
DG8GAD @ DB0KCP.DEU.EU
Joachim Scherer, DL1GJI @ OE9XPI
FAX +49 7572 6466

Why A New Concept?

Most of the existing TNC-concepts (e.g. TNC-2) are based on the Z80-microprocessor. This hardware is only good (without "tuning") for radio data rates up to 9600 bps and RS-232 rates up to approximately 38400 bps. Due to the byte-oriented data processing used, the total system throughput decreases sharply with raising baud rates. Every incoming/outgoing byte triggers an interrupt, which prevents the processor from doing higher layer tasks (ISO/OSI Ref. Mod.). Another Z80-related problem is insufficient support of high level languages. Software developers usually prefer programming in C or Pascal to implement communication software like routers etc. A Z80-based system is simply too slow to satisfy the needs of future packet radio communication applications with high data throughput and complex high layer tasks (e.g. digipeaters, bridges and gateways).

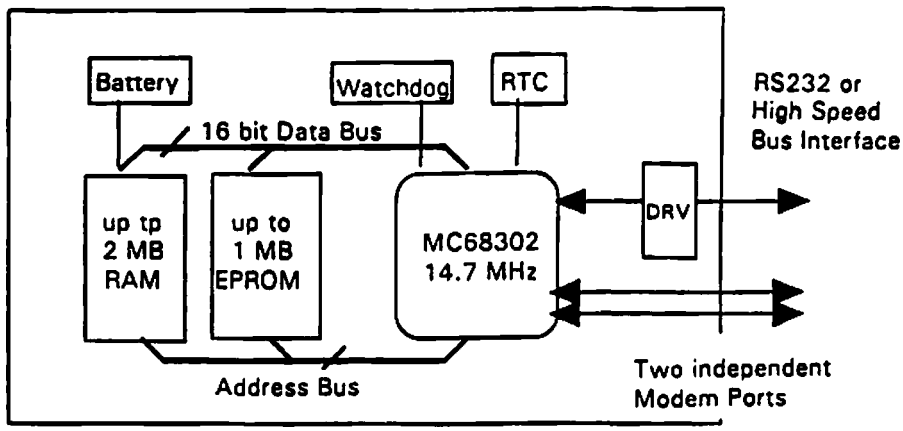
To solve the above mentioned problems, we searched for an up-to-date integrated microcontroller and decided on the MC68302 made by Motorola. This chip satisfies the requirements for a versatile high speed Packet Radio system.

The MC68302 Processor

Motorola's MC68302 is based on the well-known 68000-Processor. The CMOS-IC is available for clock rates up to 20 MHz and contains, in addition to the 68000-core many useful peripherals on-chip. This reduces external hardware to a minimum.

The MC68302 microcontroller's key features are:

- HCMOS MC68000-Core
- DMA-Controller
- Interrupt-Controller
- Parallel I/O
- Dual-Port RAM
- Three independent Timers



- Four Programmable Chip-Select Lines
- On-Chip Clock Generator
- Low-Power (Standby) Modes
- DRAM Refresh-Controllers
- On-Chip RISC Processor
- Three Independent Full-Duplex Serial Communications Controllers (SCCs) supporting HDLC/SDLC UART BISYNC DDCMP ISDN
- Six DMA Channel (Two for each SCC)

The On-Chip RISC Controller is capable of transmitting and receiving up to 8 frames on every SCC port without CPU intervention. It relieves the 68000-core from many tasks which keep the microprocessor in previous designs busy. The 68000-kernel can perform other useful tasks, even at very high baud rates. The automatic frame-reception/transmission makes it possible to implement the software in a frame-oriented rather than a byte-oriented manner. This lowers the interrupt-frequency considerably and speeds up system performance.

The features listed above make the MC68302 processor the perfect hardware platform for powerful and fast packet radio. Software can handle data rates up to the Mbit/s range with up to two independent and simulteanously working modems.

Being compatible with the MC68000 processor means a lot of existing software development tools (ATARI ST or IBM-PC-based) can be used. In particular, the C-language is efficiently supported by the MC68000 instruction set.

The TNC3 System

For the use in packet radio applications, we designed the hardware with minimum chip count and maximum efficiency. The following block diagram gives a brief overview of the TNC3 hardware.

TNC3 Hardware Features

- Two modems can work simultaneously and independently (i.e. 1200 bps and 9600 bps). Each 20-pin modem connector has RxD, TxD, TxC, RxC, CD (DCD), RTS (PTT), CTS, +5V, RESET and GND-signals.
- Easily exchangeable plug-in modems in versatile configurations available
- Modem baud rates up to 1 Megabaud
- RS232-Baudrate up to 115,200 Bd
- Battery operated Real Time Clock
- RAM up to 1 MByte (non volatile)
- EPROM up to 1 MByte
- 16-Bit-System (Data Bus)
- 16/32-Bit Processor (MC68302 with MC68000 Kernel and On-Chip RISC-Controller) operated at 14.745 MHz
- On-Board High Speed Bus Interface (TNC3 Network Interface, i.e. digipeater)
- Low Power Dissipation (CMOS ICs and Switching Regulator)
- Low RFI (RFI-Filter on-board)
- Can be used as a digipeater (at least 256k RAM necessary)

TNC3 Software Features

- The Firmware 2.3 (WA8DED Hostmode, DAMA)
- The Firmware 2.4c (WA8DED Hostmode, DAMA)

- Turbofirmware 1.31
  - High Speed AX.25 Software with Multitasking Kernel
  - WA8DED-compatible Hostmode (with extended command set)
  - Two Modems parallel and simultaneously supported
  - Auto Modem Detect (the baud rate of a connected modem is automatically detected)
  - Autoparameter (Throughput Optimization with automatic setting of P, T1 and T2)
  - TX-Delay in ms-steps
  - Cross-Digipeat-Function
  - Software PTT-Watchdog
- KISS-Mode
- High Speed Bus-Software for Network Operation
- System Test Program
- Downloadable Software

The TNC3 Operating System

The TNC3 contains an operating system supporting software development and update. It is possible to download and run software written in C on a host computer. The programs (and data) are either held resident in system RAM or can be burned into EPROMs. The download capability guarantees very short turn-around times when developing and testing new software. There is no need to program EPROMs every test cycle. When the development process is done, the software can be programmed into the EPROMs but does not have to be.

Generally, the download capability enables the developer, as well as the user, to update software without changing or programming EPROMs.

We set up "Software Designer's Kits" for the IBM-PC and ATARI ST. This kit contains all the necessary sources, including examples and libraries. Working with the ATARI ST, the low-cost compilers Turbo C 1.1, Turbo C 2.0 and Pure C (all three from Borland Inc.) can be used. For PC-based development, we determined that the AZTEC ANSI-C cross compiler Vers. 5.00 (MANX Software Inc.) works best.

The TNC3 as a Digipeater

The powerful hardware makes it possible to run digipeater software on the TNC3 system. Even with one TNC3, you can set up a digipeater. Of

Questions and Answers about the TNC3S

Is the TNC3S made for special applications only?

The TNC3 may be used where a TNC2S or TNC2H was used before. In addition, it offers enormous advantages when different modems or high baud rates are used. The modular design makes the TNC3S easy to expand and is not limited to certain modems only.

Is the TNC3S plug-compatible to TNC2S/H?

The TNC3S has the same RS-232 interface as normal TNC-2s like the TNC2S/H, the computer may be connected the same way. The modems have the same DIN-connectors as most TNC-2s.

What receive and transmit speed can be processed by the TNC3S?

The maximum baudrate of the TNC3S is about 1.6 Mbps, indeed, there are no modems available, which could handle such high baud rates. 153 kbps full duplex on both channels simultaneously is no problem for the TNC3S.

How much and what kind of memory is used in the TNC3S?

The standard version of the TNC3S has 64 kByte of RAM storage capacity. By changing the RAM-IC, it may be expanded to up to 1 MByte. 256 kByte will meet most requirements for all download, program development and digipeater use. Upgrading is done by simply changing the CMOS RAM chips and setting a jumper.

The TNC3S uses EPROM with a capacity of 256 kByte. This EPROM contains all programs (turbo- firmware, KISSmode, testprograms, operating system etc.) Up to 1 MByte EPROM is possible.

The CMOS RAM is battery backed up, so all programs and parameters are saved when the TNC3S is switched off. The MAX691 supervisory chip monitors the 5 Volt supply and switches the RAM to battery power when the external supply is insufficient.

How is the TNC3 supplied with power?

The TNC3S needs 6 to 16 Volt DC. The connection is made by a standard 5mm power supply jack. Internally, the TNC3S works with 5 Volt only. The power drain (at 13 Volt) is about 40 to 70 mA (depends on software, excluding modem power).

Does a TNC3 kit exist?

No, we do not recommend building the TNC3 from a kit.

What adjustments have to been made to the TNC3S?

The TNC3S board does not contain analog circuits (the modems are on separate boards). Adjustments are not necessary.

Does the TNC3S have a built in Watchdog?

The processor triggers the hardware watchdog of the MAX691 supervisory circuit. If there is a malfunction of the program, a reset will be generated which restarts the CPU. The modems have separate watchdog circuits, which prevent the transmitter being keyed for more than about 10 seconds.

What can I control with the DIP switches on the rear panel?

Switches 1-3 determine the terminal baudrate. Switches 4-8 determine which one of the built-in or downloaded programs will be started by the operating system at power on.

How are the modems attached mechanically?

The modems are about half the size of the TNC3S main board and are placed side by side with 4 spacers on the TNC3S board. The DCD and PTT LEDs of the modems fit exactly into the holes of the front panel, the DIN connector appears behind the corresponding hole on the rear panel. The modems may be up to 120x80 mm large, the more simple modems (about 120x30 mm) are attached with 2 screws only.

The main TNC3S board and the modems are connected with a 10 cm long 20-wire ribbon cable and the matching connectors. The modems generate the transmit and receive clock, the received data and DCD signal. From the TNC, the transmit data and the PTT control signal is sent to the modem.

What modems are available?

The modem 'AFSK 1200' is intended for 1200 Baud AFSK modulation with the tones 1200 / 2200 Hz (Bell 202). It utilizes the TCM3105 Modem-Chip and includes a 'digital squelch' with XR-2211 tone decoder chip.

The modem 'FSK-UNI' is designed for G3RUH FSK modulation at various baud rates. 600, 1200, 2400, 4800, 9600, 19200, 38400 and 76800 Baud may be selected with a DIP switch (acessible on the rear panel of TNC3S). All clocks and filter frequencies are derived from a switchable clock oscillator. The G3RUH FIR-filter, watchdog disable and bit error test switch are accessible from the rear. The modem has a high input and low output impedance. It is shipped together with a comprehensive 100 page manual, which

describes the 9600 baud FSK technique and many recommended modifications for radios to be used with FSK. Other modems are under development.

Does the TNC3 firmware support the DAMA-mode?
A Version of TF24d Firmware is built in and supports the DAMA digipeater access mode.

Is it possible to transfer software from the computer to the TNC3S?
Software and data may be downloaded from a PC or Atari computer to the TNC3S RAM memory. Downloaded application programs in RAM may be executed or even auto-started by the use of the DIP-switches. There may be several program or data files in TNC3 memory, limited only by storage capacity.

Are filters against unwanted RF radiation built-in?
All connections (RS-232, power, modem outputs) are filtered by low-pass L-C-L filters to avoid unwanted EMI radiation and susceptibility.

Are TNC3-modems suited for other applications as well?
The modems need or generate a NRZ or NRZI data signal (selectable), as it is used in all TNC-2 and RMNC controllers. The transmit and receive clock is generated by the modem itself (not by the TNC!).

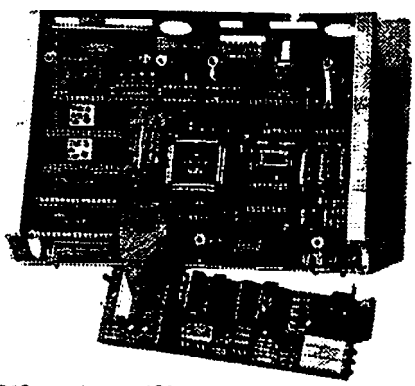
How are data rates above 38400 bps transmitted via radio?
For this application, you need special transmitters and receivers with wide RF and IF bandwidth. This would generally be possible on frequencies above 1.2 GHz (23cm). With TV broadband equipment, high data rates with the TNC3 controller are possible. The high speed serial data may also be transmitted along a cable, where, 1 MBaud or more will be useful as well.

Which acessories are supplied?
The TNC3S is supplied with a complete manual and the modem connection cables. For the download, a 3 1/2 inch diskette with PC and Atari programs is included. The modems have to be ordered separately.

How do I switch between the two modems?
The TNC3S does not work with just one or the other modem, but with both. Practically, (with Turbo-Firmware) you assign to every one of the 50 channels one of the two possible modems. For example, channel 1, 2 and 3 are assigned to modem 1, the others to modem 2. The monitor screen shows the received packets of both modems mixed, the callsign header of the monitored packets shows and from which modem the data came. For the assigning of modems and channels, the Turbo Firmware was enhanced by the #PORT1 and #PORT2 command. The KISS mode design offers already a 4-bit nibble, which contains the channel information for multi-channel TNC use.

How are the modems adjusted?
The TNC3 case has access windows on the rear panel, which give access to the adjustment pots and switches of the modems. When the TNC3 case is opened, the modem boards may be removed without disconnecting the ribbon cable to the TNC. So, measurements are possible while operating the modems normally.

How is the radio baud rate generated in the TNC3S?
The transmit clock is not supplied by the TNC but by the modem. So, any baud rate is possible, independent of the TNC internal clock. At power on, the modem clock frequency (i.e. the modem baud rate) is evaluated by the TNC and displayed.



TNC3S mit Modem AFSK 1200

course it is possible to connect multiple TNC3 systems together in a network to enlarge the possible number of ports up to 32. The digipeater software we are using is "NetNode", which is a derivative of NetRom. NetNode was developed by the German NORDLINK group and is free for non-commercial use. Sources ported for the TNC3 are also available. Our version for the TNC3 is running in various configurations:

- as a substitute for an ATARI ST in a Token-Ring together with TNC-2s (DB0ONA)
- as a single board digipeater with up to 2 links and 1 user entry.
- in a High Speed NC-Network together with multiple MC68302 systems. This configurations gives the highest possible system performance.

Availability of TNC3 and suitable Modems

The TNC3 became avaialble during the Summer of 1993. The following plug-in modems will also be available:

- 1200 bps (AFSK) TCM3105-Modem with XR2211 Carrier Detect Circuit
- 9600 bps (FSK) G3RUH-compatible Modem
- 300 bps AFSK Modem with AM7911 (available beginning of 1994)
- Modem Experimenters Board (fits in the TNC3 housing) with the necessary connectors

Software Development Kits

- Kit for ATARI ST including documentation and examples. Turbo C 1.1 (Borland), Turbo C 2.0 (Borland) or Pure C (Borland) required.
- Kit for IBM-PC including documentation and examples. An ANSI-C cross compiler (16 Bit integers) is required. The source files were written for the AZTEC 68000 ANSI-C cross compiler (MANX Software Inc., NJ)

Ported C-Software Sources

- The Firmware 2.3 and 2.4d (WA8DED-Hostmode) for TNC-use.
- NetNode (NetRom derivative) - sources for digipeater operation.

Pricing

All prices in Deutsche Marks

TNC3	490
256KB RAM	30
1200 bps AFSK modem	65
9600 bps FSK modem	150
Software Development Kit	100

The TNC3 is distributed by

SYMEK GmbH
Johannes-Kraemer-Str. 34
D-7000 Stuttgart 70
GERMANY
Phone:+49 711 7654911
Fax::+47 711 764564

TAPR 1994 Annual Meeting

The TAPR general meeting for 1994 will be held Saturday and Sunday, March 5-6 at Tucson, AZ. The site is the same as last year: the Best Western Inn at the Airport (602-746-0271). Room rate is: $54 per night which includes a complimentary full American breakfast buffet, and complimentary cocktails and hors d'oeuvres daily 5-6pm.

In addition to the "contributed paper" sessions we have had in past, we plan to have a symposium on future directions in Amateur packet radio. Invited speakers will present papers on new applications emerging in the packet arena, on the network capabilities needed to support them, and on a proposed new link-level protocol. Also in a futuristic vein, we will have a presentation on developments in the commercial sector which, it is claimed, will make the wired telephone system obsolete (and use an awful lot of bandwidth in the process!!).

The workshop planned for this year is on TCP/IP, an integrated operating/networking system which has, on occasion, created considerable controversy among Amateur packeteers. However, the workshop will be concerned only with what it can do, and how to do it, not with "whether" it should be done!!

TAPR will be publishing a proceedings for this year's annual meeting. Deadline for paper submissions is Monday, February 7th, 1994. Call the office to request an authors' information package.

Tentative Schedule:

Friday

Registration
Hospitality Suite
Dinner on the town (location TBD)

Saturday

Presentations
Lunch
Presentations
Dinner
TAPR long-range planning session

Sunday Forum

Seminar Session (TCP/IP)

We hope all of you who can attend will do so. Please send your comments and suggestions to the Program Chairman:
Keith Justice, KF7TP
KF7TP@WB7TPY.AZ.USA.NA
INTERNET: KF7TP@TAPR.ORG
or c/o the TAPR office.

Downloading files from the TAPR File Server

Lou Nigro, KW7H

TAPR has a number of files available for downloading on our system in Tucson. If you can send and receive e-mail via the Internet, then you can access the TAPR File Server.

These files include items not available in the TAPR disk library, as well as a listing and description of the files in the current disk library.

The current directory listing is reproduced in the sidebar. To get an updated directory listing of files that are available, do the following:

Send a message as follows:

```
To: file-request@tapr.org
dir
```

A listing of files will be returned to you.

To download a file, for example the list of TAPR disks, send a message as follows:

```
To: file-request@tapr.org
GET /pub/tapr/taprdsks.txt
```

This will get you the list and descriptions of disks available. Substitute the /dir/filename for other files on the directory listing to download them. (Note: Use forward slashes, not backward slashes.) You may have multiple GET lines in a message.

If you have any problems accessing the available files, please contact me at kw7h@tapr.org

Directory of Files on the TAPR File Server as of 12 Oct 1993

File Area: packet
Directory: /pub/packet/

AX25.DOC	2-01-93	66k	Docs AX.25 Amateur Packet Radio Link Layer Protocol
AX25DRV.ZIP	1-21-93	48k	AX25 driver for BAYCOM-like modem
KISS.TXT	11-11-92	20k	Info on KISS TNC Host to TNC Comm. Protocol
TNC2118A.ZIP	9-02-92	30k	TAPR TNC-2 firmware, Ver. 1.1.8a
TNC2HOST.ZIP	3-17-92	108k	Host mode software for TNC-2 with 1.1.8a firmware
GATEWAY.NET	4-27-93	2k	How to use the WB7TPY Packet<->Internet Gateway
TNC2DOC.ZIP	4-14-93	122k	System Manual for the TNC-2
TNC2KISS.HEX	5-21-92	5k	KISS EPROM Code for TNC-2
TNC1KISS.ZIP	6-21-93	47k	KISS host to TNC Protocol for TAPR TNC-1 & clones

File Area: sat
Directory: /pub/sat/

ARSENETM.ZIP	5-10-93	38k	ARSENE satellite telemetry decoding package

File Area: tapr
Directory: /pub/tapr/

32K.TXT	1-06-93	1k	How to upgrade the TNC-2 to 32k RAM
9K6MODEM.TXT	12-19-92	3k	Info on the 9600 baud TAPR Modem
DCD.TXT	12-09-92	4k	Info on the Data Carrier Detect Kit
METCON.TXT	2-09-93	2k	Info Remote Telemetry & Control Kit
PSKMODEM.TXT	1-02-93	3k	Info on TAPR PSK Modem Kit
TAPRINFO.TXT	4-18-93	3k	Info on TAPR and its goals, etc..
TAPRKITS.TXT	4-07-93	17k	Info on kits available from TAPR
TNCBOARD.TXT	12-09-92	1k	Info on the TAPR TNC-2 printed ckt board
SHIPPING.TXT	7-30-93	3k	Shipping cost for TAPR items to foreign countries
TAPRDSKS.TXT	10-11-93	10k	Descriptions & list of disks in TAPR library
DISKS.TXT	7-25-93	2k	Notice on ending 5 1/4" diskette distribution

File Area: utility
Directory: /pub/utility/

UUEXE521.EXE	7-10-93	48k	UUENCODE/UUDECODE prgms. - Ver 5.21 - self extracting
UUDECODE.BAS	7-18-93	6k	BASIC program to create UUDECODE.COM
UUDECODE.DOC	7-18-93	2k	Docs for UUDECODE.BAS

Message Command Language for TAPR File Server

There are some general rules for commands:

- Commands and operands are, in general, not case sensitive;
- Leading spaces are permitted before the command. Commands must be the first token on a line.
- A '#' character as the first character on a line is treated as a comment. The line does not cause an error.
- A line beginning with the string "—" is treated as end of input. The remainder of the message is ignored.

1. The HELP Command

The HELP command causes the File Server to send the "help" file (this file). Anything after the HELP on the line is ignored.

2. The DIR Command

The DIR command causes the File Server to send a directory listing of files available from the file server. Anything after the DIR on the line is ignored.

3. The NEWFILES Command

The NEWFILES command causes the File Server to send a list of files newer than the user specified date. The request for NEWFILES is queued like the DIR request.

The syntax for the NEWFILES command is:

```
NEWFILES <date>
```

<date> is required. <date> has the form of mm-dd-yy. The File Server is strict about checking the form of <date; if it does not look like it expects, the command will be rejected.

A valid specification for the NEWFILES command is:

```
NEWFILES 02-15-92
```

4. The GET Command

The GET command causes the File Server to send a file to the requestor.

The syntax for the GET command is:

```
GET <filespec> [uue[ncode] | xxe[ncode]]
```

<filespec> is required. <filespec> must specify a path, but without a drive specification. The filespec is not relative to any directory.

uuencode or xxencode is optional and may be abreviated as "uue" or "xxe", respectively. If neither are specified, the file is sent according to the rules for sending files set by the system administrator. That is: the system administrator may define a list of file extensions that will always be uuencoded for transmission; also the system administrator may define a file size limit such that any file larger than this limit will be uuencoded for transmission.

If uuencode is specified, the file is sent uuencoded.

If xxencode is specified, the file is sent xxencoded.

For example:

```
GET /pub/tapr/taprinfo.txt
GET /pub/packet/tnc2kiss.hex
```

are syntactically correct.

```
GET c:/autoexec.bat
GET e:/wfs/src/wfsreqst.c
```

are not syntactically correct; both incorrect examples have a drive specifier.

```
GET autoexec.bat
GET src/wfsreqst.c
```

are not correct. Both do not specify the leading slash.

5. The PING Command

The PING command causes the File Server to make a simple reply, via the session transcript, to the requestor. To test the path to the File Server at a site, send the PING command.

6. The QUIT Command

The word "quit" as the first token on a line causes the File Server to quit processing input as if end of input had occurred.

TAPR DevMtr Notes

Lyle Johnson, WA7GXD

There have been a few minor problems and misunderstandings about the TAPR Deviation Meter kit. I hope this article will help to dispell some of them!

1) The directions for S1 and S2 are reveresed. If you don't get the action called out in the directions, press the other button!

2) Some kits were shipped with an incorrectly programmed PLD (18CV8). The symptom is that the DevMtr will sign-on, but it will not accept any keystrokes from your computer.

   If you have this symptom, contact the office and we'll see to it that a replecement is sent in exchange for your old one. These parts are reprogrmmable, so the old one may be re-used.

3) Some kits were shipped with a DE9P connector for the PC board serial port connector. The correct connector is a DE9S (female sockets, not pin contacts).

   If your kit has the wrong connector, contact the office for instructions on getting a replacement. Or, you may use the one supplied, just swap pins 2 and 3 in the directions and use pin 1 for ground instead of pin 5.

4) Not all TNCs have a CAL mode. The calibration instructions ask you to make the TNC send its high tone and then set the transmitter deviation.

   YOU MAY CALIBRATE THE DEVIATION USING A NORMAL PACKET AS WELL AS A TONE! THE ONLY WAY TO GET IT WRONG IS TO SEND ONLY A STEADY LOW TONE!

   The DevMtr will also calibrate for voice or almost any other waveform. At least one person wanted to return the DevMtr because he thought it would only work with a steady high tone. I apologize for my unclear instructions in the manual.

5) The DevMtr source code and development tools are now available as TAPR disk 14 in the software library.

6) The Radio Shack PRO-58 scanner may be used with the DevMtr. The following connection points are untested, but believed to be accurate:

Detector Audio (DISC) - IC2 pin 9, or TP5.

CAL OSC - IC2 pin 16.

Squelch - IC2 pin 13. Sense is 0V = no signal , +5V = signal present.

There is no source of switched +12V available in this unit.

New MicroSats - A Personal View

Lyle Johnson, WA7GXD

Ariane V59 launched another bevy of MicroSats into orbit. These satellites are in essentially the same orbit as the previous flock, including PACSAT and LUSAT.

ITAMSAT (IO-26) is a packet store-and-forward satellite using 1200 bps Manchester uplink and PSK downlink. It has four 2-meter uplink frequencies and two 70 cm downlinks (one downlink active at a time). It also includes a 9600 bps FSK modem and a 1200 bps AFSK modem. A simplified version of the original flight computer is used, with ITAMSAT doing the computer modifications and construction.

EYESAT, also known as AMRAD-OSCAR 27 (AO-27), has a part-time Amateur payload. This is the first commercial license of the AMSAT MicroSat design that I am aware of. AO-27 has a much improved flight computer over previous MicroSats with several times the computing horsepower, greatly expanded mass storage and EDAC (Error Detecting and Correcting) capacity and draws even less power than the original!

In addition, it has a very flexible modem scheme. A 1200 bps AFSK downlink can be copied by any TNC with a radio tuned to 436.8 MHz. The downlink can also accomodate direct FSK (with or without "scrambling") at data rates from 300 bps to 19,200 bps. Corresponding uplinks in the range of 1200 bps to 19,200 bps can also be switched in, as well as standard MicroSat Manchester 1200 bps and 4800 bps uplinks.

A new twist incorporates an analog loopback mode for very high-quality FM voice communications. I operated this on October 9th from the AMSAT-NA Annual General Meeting and Space Symposium in Arlington, Texas. Mark Kanawati, N4TRP, was commanding and operating AO-27 from Wasyhington, D.C. Several other operators were also active on that pass and we all had excellent communications.

Chuck Green, N0ADI and I assisted in some of the experimental development and had the priviledge of accompanying AO-27 to Korou and participating in the launch preparations.

To quote Harold, NK6K, "Korou is the kind of place every ham should get to go to once — and no one should have to visit twice!" It was certainly interesting!

Kitsat-Oscar-25 was also launched on this same mission (a twin of KO-23 but in a different orbit). This is a sophisticated digital satellite and we congratulate the KAIST people on their success.

Surrey was well represented with "HealthSat," a digital communications satellite, and as tutors and mentors for PoSat, a Portuguese satellite with an Amateur payload that we all look forward to seeing put into operation. Congratulations to Martin Sweeting, Jeff Ward, and the entire Surrey team for another successful set of satellites!

Phase 3-D design is progressing nicely. During the last couple of months I and several other TAPR regulars (including Chuck Green, Bdale Garbee, John Connor, Phil Karn, and Tom Clark) have become heavily involved in putting a GPS experiment aboard this new satellite.

The GPS experiment will work in conjunction with another module to produce a disciplined oscillator. A disciplined oscillator is one that we can warp its frequency to achieve our ends — in this case those ends are (a) stability correction for temperature and aging effects, and (b) to pre-correct for doppler at nadir (the center of the earth). While few us (apart from Jules Verne) have ventured to this location, it means that you only have to correct for the fact that you are on the surface of the planet and that it rotates. At 10 GHz or even 24 GHz, this really helps!

GPS provides precise timing, so we can use this to correct another master oscillator (not doppler steered) for extremely precise frequency correction, including correction for thermal and aging characteristics of the oscillators.

In addition, GPS will help us know precisely where the satellite is for orbital correction maneuvers. As a sideline, the experiment will try to verify the spacecraft's attitude.

Stay tuned, a GPS kit that lets you get into the innards of GPS, including algorithms and internal software, may spin off from this. This won't be a consumer-oriented GPS widget — it will cost too much — but it will help you LEARN what makes it tick if this appeals to you.

Oh well, I'd better get back to work (at my hobby).

*** Connect Request

This column is where you can get in touch with other packeteers who may have similar needs or interests. If you have a question about packet radio, or are looking for a particular type of unusual hardware or software, this may be the place for you. Send your requests to TAPR at any of the usual addresses. Also, please help your fellow Amateurs by responding to requests that you know the answer to.

Request:

I have two requests:

First, I am currently in correspondence with hams in Slovakia. I have sent old gear to Bratislava and it is now in service there. I would like to get a hold of old TNC's for use in Eastern Europe. Cost is a factor as shipping is ferocious.

Also, I am currently using the PacComm TNC and I noticed that there is a different chip for Europe. Is their packet different from ours? Would old TNCs not be useable in Europe?

Paul Taylor, WB2GIN
1 Penfield Ave.
Croton, NY 10520
(914) 271-5176

Response:

The TAPR firmware works fine in Europe. I don't know why PacComm would use a different chip. Unless... maybe somebody came up with a hack to do CW identification, which is required in the UK and possibly elsewhere. —Bob Nielsen, W6SWE

Request:

The Veterans Amateur Radio Club is seeking a packet program for a Kaypro II computer single-sided diskette CP/M. This computer is about 10 years old. We can't find anyone locally that has a Kaypro computer and this was donated to the VA. We just want a diskette that will turn the computer into a terminal for packet. We can send someone a diskette if you know anyone using the Kaypro. Any help or information would be very much appreciated.

Don Simonsen, K7AEJ
Veterans Amateur Radio Club, K7ESJ
VRT 117-H
VA Domiciliary
White City, OR 97503

[The following dialog came from the HamNet Forum on CompuServe.]

Request:

A friend of mine who is blind and has been an Amateur for many years has recently expressed an interest in packet radio. I wonder if anyone has either:

1) Heard of a blind amateur who is active on packet, or

2) Knows something about software that would be helpful in getting a blind ham active on packet radio. Thanks!

Chuck Wyatt, KB5GC
72712,2517

Response:

I have helped several dozen sightless Amateurs learn to enjoy the excitement of the digital modes. And not just packet either, but also Amtor, Clover, Pactor, RTTY, and automatic Morse.

I'm presently rewriting our "ARRL Program for the Disabled" book (a freebie), the old — VERY old! — version of which was painfully outdated and absolutely ignorant of enabling computer technology for the disabled.

The circuit board I'm presently fondest of is COVOX's "Sound Master 2" which does a number of VERY interesting things for the handicapped:

1. It reads text. Any text. Speaks it to a pair of (supplied) speakers so that the sightless can hear anything in the way of a text file, or anything that comes in via a comm port (!) etc, etc. That's neat all by itself, but it gets better...

2. The user can record ANY sound or person's voice. ANY sound. Via the supplied headset/microphone. And the reproduction is absolutely, 100% perfect. And with the appropriate (free) software, any format of sound, from Soundblaster files to Adlib files, (anything I've ever run across, certainly) can be quickly changed to files that the Sound Master 2 can quickly deal with. It's duck soup.

3. Now we get to the REAL beauty of this cheap little circuit board. It does voice recognition! We did an article in QST last year, purportedly so that Amateur Radio contesters could control many aspects of their hi-falootin rigs via voice control. "Hoo HAH!" sez I "I can certainly think of a bejillion better uses than THAT". At which point I obtained funding for a large number of SM2s and promptly landed them in disabled people's hands at no charge.

At any rate — voice recognition. Through the above-mentioned headset, (although I've certainly wired up a number of D104-type mikes for those with REAL severe motor skill impairments), the user can speak, and the computer can control anything that operates from 117 volts (via X-10 modules). X-10 devices, coupled with the SM2 allows a severely disabled Cerebral Palsy patient, for example, to utter something otherwise unintelligable to you and I, perhaps, and have that utterance control, say, a thermostat, a garage door opener, or a toaster, although I confess that I've never been able to get the dadgum piece of BREAD to go down, har! SM2 is very simple to train to the patient's voice patterns and even offers security. For example, one CP patient I know uses it to open her front door from outside. NOBODY can mimic HER voice!

4. Now, some interesting examples — or at least one — of how the various features of SM2 can be used by the disabled, might be of value:

A. Mark has multiple problems. He has limited motor skills and is legally blind. SM2 and various kinds of shareware programs can enable him to find his way around ANY of his screens, using — and here's a very important point — even the oldest and cheapest of IBM computers. They're so cheap that I've had dozens of them donated. No problem there, and a topic for another discussion, certainly. But the point is that SM2 works perfectly well with even an old PC or XT. So Mark can now "see" his computer screen, albeit slowly, by using the cursor keys to go anywhere on the screen and having the SM2 board read by character, full screen, complete file, or even repeat portions of what he may have missed. Great for studying the Amateur Radio question pools!

B. Debby has CP, and can move a VERY limited number of muscles below her neck. Her speech is such that she can not communicate by telephone with any but her closest friends. SM2 allows her to do packet because she can — in her own sweet time, but she has infinite patience — say the letters "Alpha," "Bravo," "Charlie," etc., and have SM2 slowly type her packet message into a buffer, and then spit the whole thing out at the same speed that the rest of us do. Now, Debby has complete access to the worldwide Amateur Radio digital networks. And she's delighted.

Luck Hurder, KY1T
ARRL HQ Newington CT
70007,3373

[By special request, the PSR is available on disk for use by blind hams, contact the TAPR office for information.]

Renew Your Membership!

TAPR doesn't send out constant reminders when your membership has expired. Our only way of communicating your expiration date to you, is the date on the address label for this issue. Please check it and renew if required. Your membership is very important.

Software Library Update

Lou Nigro, KW7H

In addition to supplying various kits and firmware, TAPR maintains a library of packet radio-related computer software. Disks are currently available in 5-1/4 in. MS-DOS format for $2.00 each, and in 3-1/2 in. for $3.00 each, including mailing (slightly more for foreign orders).

TAPR will discontinue distribution of software on 5 1/4" diskettes as of March 1, 1994. We will provide, on an exception basis, as time permits, software on 5 1/4" diskettes for those of you who cannot handle 3 1/2" media. After 3/1/94 the cost of 5 1/4" diskettes requested on an exception basis will be $3.00 each, and orders for them will only be accepted via phone or E-mail so we can advise you about availability and any delays in shipping.

Additions to the software library are always welcome, however we do request that they be submitted either by, or with the expressed permission of, the author. TAPR attempts to provide the latest versions of all software; updates are appreciated. TAPR reserves the right to screen any submissions and restrict the library content as necessary. Both freeware and shareware are acceptable.

The following is a brief description of the newest listings in the TAPR software library:

34. GIL - Graphics Interchange Language - Permits a convenient way to tramsmit more than just ASCII text messages, such as animated graphics drawings or diagrams over digital radio links.

35. PAKET - A TNC-2 program with features such as windowed operation and multi-connects.

36. F6FBB BBS - Supports 15 languages, YAPP support, multiconnects, compressed message forwards

37. TPK - French language version of YAPP. By Gerard Regnard, FC1EBN.

38. KA9Q NOS - Executables and documentation for KA9Q's NOS version of TCP/IP software, with enhancements by Gerard van der Griten, PA0GRI and Johan Reinalda, WG7J.

39. KA9Q NOS - Source code for Executables on Disks 38/38A.

40. SP (Eskay Packet) - Hostmode program by DL1MEN for WA8DED firmware with additional support for Baycom modems & KISS TNC's.

41. TAPR Deviation Meter - Source code and tools.

42. PACTOR - PCTOR runs AMTOR (CCIR476-6) on a PC compatible. All AMTOR modes & listen are supported. Requires external HF Modem such as CP-1, ST-6, DJ6HP or similar. Also includes PC-PACTOR for read only of PACTOR traffic on a PC compatible.

Current versions in TAPR software library - As of 1 October 1993. Items with ** notation have been updated since last listing.

Disk No.	Name	Version	Date
1/1A .	APLINK	Ver. 7.01	02-28-93**
2/2A	AA4RE BBS	Ver. 2.12	03-31-91
3.	CBBS	Ver. 7.20	01-05-93**
4.	EZPAC	Ver. 1.1	01-09-89
5.	MONAX		10-30-87
6.	Ham Comm	Ver. 3.08	03-08-91
7.	TNC-2 Manual and EPROMs		09-29-92
8.	R95	Ver. 4.0	01-25-92
	7PLUS	Ver. 1.63	01-02-92
	UUENCODE/UUDECODE	Ver. 5.21	01-26-93
9/9A	ROSERVER PRMBS	Ver. 1.73	05-08-92
10.	ROSE X.25 SWITCH	Ver. 3.1	07-29-92
11/11A	KA9Q NET	Ver. K29	05-18-93
12.	WXN Weather Svr.	Ver. 3.19	04-20-92
13.	TNC1 CODE & TNC2 Notes		03-28-90
14.	Deleted; now included on disk 13.		
15.	WA7MBL BBS	Ver. 5.14	02-11-90
16.	W0RLI BBS	Ver. 14.2	08-17-92
17.	YAPP	Ver. 2.0	12-18-86
18/18A	INTRO TO TCP/IP		09-09-87
19/19A	LAN-LINK	Ver. 2.01	07-06-92
20.	ARESDATA	Ver. 1.6	12-31-92**
21/21A/21B	MSYS	Ver. 1.15	06-30-93**
22.	G8BPQ NODE	Ver. 4.06F	04-25-93
23.	UTILITIES		
	PKARC	Ver. 3.6	
	PKZIP	Ver. 2.04G	
	LHA	Ver. 2.11	
	ZOO	Ver. 2.10	
	UUENCODE/UUDECODE	Ver. 5.21	
24.	THS	Ver. 2.50	11-11-89
25.	VE4UB NTS	Ver. 091891	09-18-91
26.	NM1D DOSGATE	Ver. 1.14	11-29-89
27.	SV7AIZ BBS	Ver. 3.24	04-05-90
28.	TEXNET	Ver. 1.6	02-05-91
29.	INTRO TO PACKET RADIO, A Tutorial		05-07-93**
30.	MICROSAT GROUND-STATION SOFTWARE		
	PB		10-09-92
	PG		02-25-92
	PFHADD		10-09-92
	PHS		12-21-90
31/31A	No Longer Available (see 38/38A)		
32.	PAMS-Personal AMTOR Mailbox	Ver. 2.08	11-26-92
33.	TNC-2 Z-80 Monitor	Ver. 2.00	09-02-91
34.	GIL	Ver. 1.03	03-30-91
35/35A.	PAKET	Ver. 5.1	04-06-92
36/36A/36B.	F6FBB BBS	Ver. 5.15	03-06-93
37.	TPK	Ver. 164A	04-14-91
38/38A	KA9Q JNOS (Executables, docs.)	Ver. 1.08B	02-25-93
39/39A/39B.	JNOS (Source Code for 38)	Ver. 1.08B	
40/40A	SP Packet	Ver. 6.01E	02-06-92
41.	TAPR Deviation Meter Source and Tools		10-01-93**
42.	PCTOR/PC-PACTOR	Ver. 3.02A	08-10-93**

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TAPR is a Non-Profit Research and Development Corporation

Order Form

Summer 1993

All prices subject to change without notice and are payable in U.S. funds. Prices include shipping and handling except foreign air.
Please allow six to eight weeks for your order to be shipped. For specific information on kits, see Product Description flyer.

Kits and Firmware

Qty	Item	Unit Price	Total	Information
___	TAPR 9600 bps Modem	$ 70.00	_____	
___	Bit Regenerator	$ 10.00	_____	used for regenerative repeater operation
___	Clock Option	$ 5.00	_____	used for regenerative repeater operation
___	Deviation Meter	$ 90.00	_____	
___	Trak-Box	$ 195.00	_____	limited kits available
___	METCON-1 Telemetry/Control	$ 75.00	_____	includes 8 input, 4 output ports
___	4 additional output ports	$ 15.00	_____	
___	Voltage-to-Frequency module	$ 25.00	_____	
___	Temperature-to-Freq module	$ 35.00	_____	
___	A-D Converter	$ 45.00	_____	
___	Elapsed Time Pulser	$ 30.00	_____	
___	PK-232 Modem Disconnect	$ 20.00	_____	simplifies connection of external modems
___	PK232MBX Installation Kit	$ 15.00	_____	for installation of 9600 modem in PK-232MBX
___	XR2211 DCD Mod.	$ 15.00	_____	
___	State Machine DCD Mod.	$ 15.00	_____	
___	State Machine DCD w/Int Clock	$ 20.00	_____	For KPC2 or other TNC w/o 16X or 32X int clock
___	PSK Modem	$ 115.00	_____	limited kits available
___	Cabinet for PSK Modem	$ 10.00	_____	
___	TNC-2 bare PC Board	$ 30.00	_____	No parts. Incls schematic, manuals, EPROM code.
___	32K RAM w/ TNC2 update docs	$ 20.00	_____	
___	TNC-2 1.1.8a w/KISS EPROM	$ 12.00	_____	includes 1.1.8 Commands booklet
___	TNC-2 WA8DED EPROM	$ 10.00	_____	8 connect version for ARES/Data standard
___	TNC-1 WA8DED EPROM	$ 10.00	_____	
___	PK-87 WA8DED EPROM	$ 10.00	_____	
___	TNC-1 KISS EPROM	$ 10.00	_____	
___	TNC-2 KISS EPROM	$ 10.00	_____	
___	1.1.8 Commands Booklet	$ 5.00	_____	full TNC-2 command set for 1.1.8
___	PSR Set Issue #1 to present	$ 30.00	_____	
___	TAPR Badge	$ 10.00	_____	include Name and Call for badge

Software — please circle disk numbers requested (see PSR or contact the TAPR office for a current list).

___	5-1/4 Disks (each)	$ 2.00	_____
___	3-1/2 Disks (each)	$ 3.00	_____

1	2/A*	3	4	5	6	7	8	9/A*	10
11/A*	12	13	14	15	16	17	18/A*	19	20
21/A*	22	23	24	25	26	27	28	29	30
31	32	33	34	35/A*	36/AB*	37	38/A*	39/AB**	

* Indicates one 3-1/2" disk. ** Indicates two 3-1/2" disk.
See Separate list for descriptions of these software packages. TAPR attempts to provide the latest versions of all software.

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TAPR is now accessable through the Internet. You may send e-mail messages (no long files, please) to the TAPR office at

`tapr@tapr.org`

and to any of the directors at

`callsign@tapr.org`

substituting their call for "callsign." Also, submittals for *Packet Status Register* may be sent to

`psr@tapr.org`

in addition to the CompuServe address on the front cover.

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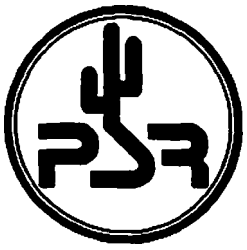

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