PACKET STATUS REGISTER

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A Non-Profit Research and Development Corporation

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In This Issue...

President's Corner

What is a 'smart' radio and is our spectrum really utilized, or just occupied with 20+ year-old technology?

Although the concept of 'smart' radios is not something new, one of the best articles I have read in some time was recently published in the June *Forbes ASAP* by George Gilder, which is available on-line [Gilder, 1997]. This last year, Dave Sumner, Exec Vice President of the ARRL, wrote about these concepts after attending the Spectrum En Banc hearings held by the FCC in which Paul Baran (grandfather of the Internet) spoke [Sumner, 1996]. The basic concept is the maximum reuse of spectrum by building radios that can determine where and how to operate. "Baran's written testimony described the need to move away from the communications model of 'dumb transmitters talking to dumb receivers' and toward networking with 'smart' equipment having greater tolerance for impurity (i.e., interference), maximum reuse of the spectrum through shorter range transmitters, and incentives to maximize shared use of spectrum and to minimize spectrum 'warehousing.' [Sumner, 1996]." These concepts have been a major focus for some time with those working within TAPR on the Spread Spectrum technology issues. The stormy news to some is that these modern-day 'smart radios' will be built on Spread Spectrum technology. We now find ourselves in a rulesmaking process at the FCC that could seriously jeopardize the Amateur Radio Service's (ARS) place in history

Look for TAPR at these Upcoming Events

Oct. 10-12, 1997 — ARRL & TAPR Digital Communications Conference - Baltimore / Washington International Airport

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for the creation of such devices over the next five years, all because the Notice of Proposed Rule Making (NPRM) regarding changes to the Spread Spectrum rules may not go far enough in some areas or may actually be worse than those written in 1985 in other areas. (http://www.tapr.org/ss/rule_changes.html)

As Gilder states "... frequency shortage is caused by thinking solely in terms of dumb transmitters and dumb receivers. With today's smart electronics, even occupied frequencies could potentially be used." [Gilder, 1997] The approach some would take today, while TAPR is focused on working towards future spread spectrum radios, falls under the concept of less than intelligent transmitters and receivers. These less than intelligent radios are going to be less expensive to implement and easier to comprehend under the current paradigm of digital systems, but where do we find the 10-20Mhz of spectrum that doesn't interfere with anyone else, so that we can operate these more traditional high-speed radios using methods developed in the last 20 years? Probably on bands that will be very difficult to implement them on, that also cost more to produce, and don't offer much distance for communications in either a metropolitan or local area.

With regard to the issue of 'is our spectrum being occupied or utilized,' "The chief reason for the apparent shortage of spectrum, he concluded [Baran], is regulation of it." Echoing his earlier critique of wireline communications, he declared that "the present regulatory mentality tends to think in terms of a centralized control structure, altogether too reminiscent of the old Soviet economy. As we know today, that particular form of centralized system ... ultimately broke down. Emphasis with that structure was on limiting distribution rather than on maximizing the creation of goods and services. Some say that this old highly centralized model of economic control remains alive and well today-not in Moscow, but within our own radio regulatory agencies." [Gilder, 1997].

"The heart of the problem is the concept of spectrum as public property — as scarce real estate or a precious natural resource. Spectrum is nothing of the kind. It has been created by a series of brilliant technical innovations, beginning with Marconi and continuing in a steady stream of high technology oscillators and digital signal processors: from magnetrons and klystrons to varactor multipliers and surface acoustical wave devices, from gallium arsenide and indium phosphide heterojunctions to voltage-controlled oscillators and Gunn or IMPATT diodes. Spectrum is chiefly a product of inventors and entrepreneurs. Americans will rue the day when foreign governments and international organizations begin

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

Article submission deadlines for upcoming issues:

Fall 1997	September 15, 1997
Winter 1998	December 15, 1997
Spring 1998	March 15, 1998
Summer 1998	June 15, 1998

Submission Guidelines:

TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you, or someone you know, is doing something that would interest digital communications, please contact the editor so that your work can be shared with the Amateur community.

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

auctioning and taxing, marshaling and mandating the use of those mostly American technologies. [Gilder, 1997]"

"The real estate model applies chiefly to broadcasters and others using analog modulation schemes in which all interference shows up in the signal. A television signal requires some 50 decibels of signal to noise power, or 100,000-to-1. By contrast, error-corrected digital signals can offer virtually perfect communications at a signal-to-noise ratio well below 10 decibels, or 10,000 times less. Moreover, new digital systems can divide and subdivide the spectrum space into cells and differentiate calls by spread-spectrum codes or even isolate particular connections in space by space-division-multiple-access devices that function as "virtual wires" allocating all of the spectrum to each call. [Gilder, 1997]"

Paul Baran and George Gilder have been writing about these above issues for some time now and this subject is of particular relevance if we read the comments and reply comments to the latest comments and reply comments regarding FCC Docket 97-12 the amendment of ARS rules to provide for greater use of spread spectrum communication technologies (http://www.tapr.org/ss/rule_changes.html). Many of the comments discuss the need for less regulatory mandates to allow experimentation to drive what technology is being developed within the ARS. Others don't share these views as you would expect within such a diverse hobby as amateur radio. Some of the comments are easily definable as the protection of existing "spectrum warehousing," by the fact that other amateurs don't want any new mode operating in "their" part of the spectrum that could possibly interfere with what they do as part of the hobby, even when all of amateur radio is shared among all users. However, much of the perception of Spread Spectrum technology is driven by the yeoman service done by AMRAD in the early 1980s, which led to the current Part 97 rules on spread spectrum and also by the ARRL "Spread Spectrum Sourcebook." However, many of these beliefs on how Spread Spectrum behaves among other users of the spectrum is based on 1970s technology or on analogies that deal with military radars or other systems that are not relevant to digital communication systems. The "smart" radios that Gilder talks about and amateur radio must be implementing is based on 1990s technology, not technology from 20 years ago.

The only reason we can't share our amateur radio spectrum and must have band-plans is because we choose to use older analog modulation schemes in which all interference shows up in the signal. With a "smart radio," even if we use segments of the bands that amateur satellites, weak-signal, EME, and voice repeaters operate on, these radios can avoid certain narrow spectrum when it senses potential interference possibilities. We must view spectrum utilization as a local issue for these types of new radios, not as a national regulatory policy. Let's take a few examples. There are maybe several hundred EME operators spread throughout the US. How many hours of the day, week, or year does one of these EME enthusiasts actually operate their system? If the EME station keys up to transmit at the moon, doesn't the local "smart" radio hear that signal, know what the sub-band is used for, and then avoid that segment for say 12 hours? Take amateur satellite operations, how often is a satellite on a particular sub-band or frequency available for operation during any one day? Again, these satellites operate on frequencies of sub-bands. When a "smart" radio sees operations by a station could it not just keep monitoring that freq. and wait for some period of time to start to use it again? This approach works very well for voice repeater band segments in which many hours of the day voice pairs go unused, but during a few hours of the day have high-peak traffic use. The above examples are based on the assumptions that 1) we have an amateur radio operator using this mode in a 10-30 mile radius of a "smart" radio and 2) that these new radios are going interfere. However, the purpose of using spread spectrum technology is to build radios that can use much lower power to accomplish their operations and at the same time not be apparent to other users on the spectrum far away. Thus, if you don't have any local EME, satellite operations, or whatever, you don't have to worry about point one and will be able to use all the spectrum you have available to you instead of following a band plan that doesn't necessarily apply to your area. Although, if you live in a metropolitan area, then much of the intelligence of the radio gets used more often. Also, if these radios really are as transparent as we hope they will be to other users in the spectrum, possibly only a small segment of the amateur radio population, say weak-signal operators, need to be worried about point number two.

With the types of "smart" radios that TAPR intends to design, amateur radio could once again be on the leading edge of technology. However, if the FCC listens to those against new technology innovations or issues regarding protection of other operating modes, and the FCC issues a final Report and Order that doesn't truly allow experimentation and implementation of advanced Spread Spectrum communication devices, then we could be so seriously hobbled, as to be unable to contribute meaningfully to the advancement of the ongoing telecommunications revolution. This, because a small group within our hobby are afraid of new innovations that might cause a certain amount of dislocation within what they perceive to be their operating interest.

Amateur radio as a whole has a decision to make: do we advance and participate in the wireless communications revolution underway and be a key player

in it, or do we sit on the sidelines waiting for our spectrum to be taken away so that we can at least operate the way we have for the last 20 years for another 5-10 years? If we don't become active participants with rules that allow for that participation, then other commercial services will produce the necessary technology and we will find ourselves losing our spectrum in the coming WRC conferences. These are the same frequencies that provide communications in times of emergency, proving grounds for new technology, and recreation to many that participate in our hobby, but could eventually go to other services that show better utilization and outcomes.

Another potential downfall is that there is a group of decision makers that feel that any new technology should be forced to the higher bands, because they believe "amateur radio needs to have things operating up there." This is the "use it or lose it" concept. One reason that many amateurs are not on these 'higher' bands is the cost, difficulty in making such systems work because of a lack and cost of test equipment, and the usefulness of some of these higher-bands in the 'mobile' environment. It makes sense to build these smart radios in places on our bands that offer the greatest potential for frequency reuse and utilization and also on under-utilized higher-bands where we can make systems go faster because of more spectrum width. We will build 1.54Mbps (T1) and faster radios starting on 1.2Ghz and up, however, saying we shouldn't develop slower data and voice systems on 2 meters or 70 cm because people already operate there is difficult to comprehend. These are the bands that need the technology described above the most. Bands where people can no longer get coordinated (i.e., warehoused) spectrum to build traditional systems on bands that are really underutilized based on the number of people using them, but heavily occupied because of band planning that limits where people have agreed to operate.

Do we want to see amateur radio go the way of the "Soviet economy" as Gilder points out or do we want to keep amateur radio in the spotlight of technical innovation and leadership? I know what my answer is...do you know what yours is?

To finish this segment, let me quote David Sumner, Exec Vice President of the ARRL, again "First, the rules of the game are changing. As incumbent users of the spectrum, we must realize that the yardstick by which our use is measured is getting longer. Second, digital technology gives us powerful new tools to enhance our own service — tools that we have barely begun to think about using [Sumner, 1996]." "To let the telecommunications revolution start without us would be as short-sighted as failing to convert from spark to CW, or from AM to SSB. [Sumner, 1996]."

If what David Sumner wrote about the future is correct, then the comments and reply comments filed by the ARRL and others concerning the changes in rules for Spread Spectrum don't reflect this perception of the future at all. They reflect an attitude of accepting what the FCC has proposed for the new rules without question or of keeping the status quo of spectrum protection and operating modes and not encouraging experimentation and implementation of new modes to keep the hobby alive and growing into the next century.

What is a long range vision and how does the TAPR membership participate now?

Four years ago now, several of us started looking seriously into Spread Spectrum communications techniques as a possible solution to the several critical factors that faced both the aspects of digital communications and the hobby in general. I won't cover them here, since I have covered them in past columns (http://www.tapr.org/tapr/html/presidents_corner.html). I have stated in those columns that the TAPR long range plan in this area is going to take time. I have received messages on e-mail and USENET that state 'now that TAPR has said it is doing something — why hasn't TAPR completed it yet?' Well, the answer is "it takes time to implement new technology, especially technology that now integrates RF into the design" and "technology that requires rules changes to make it practical to make available." The current rulemaking process has been under way for over two years now. I think the vast majority of TAPR members understand this, but many non-TAPR members don't see this and expect it to be happening now.

If we look back on the current long range vision statement from TAPR, we can see the roots of these thoughts as far back as 1988, when Pete Eaton proposed the TAPR PacketRadio project. Pete had the correct vision and if the project had been successfully completed, there is no telling just how much that project would have changed the face of current amateur radio digital communications. To date, the packetRadio was the only project that TAPR had attempted that involved the integration of digital and RF elements into the design. All the other successful TAPR projects to date have just focused on the digital side of things. With Spread Spectrum digital communication systems, the integration of RF and digital elements is crucial to the success of both making it work and making it available at a price amateur radio enthusiasts will perceive as acceptable and plunk down their cash to purchase.

To this end, at the TAPR Board of Directors meeting held in Dayton in May, the board voted to fund the initial stages of a 900Mhz 256Kbps FHSS (Frequency Hopper) design. This is one of two designs that TAPR should be undertaking in the next year. The second design, which we believe will target either 2.4GHz or 1.2GHz and

operate at speeds up to 1.544Mbps (T1), is on hold awaiting for the NSF (National Science Foundation) grant to support the development project to be started. Both radios fall into a category of being intelligent. This is something that many of us have been discussing informally for the last two years and is a key part of the NSF grant proposal. The 900Mhz radio design group has asked that their identity be kept quiet so as to give them time to devote their energy to design and development. This group has past experience in the necessary areas and I think we will see something eventually. We must give them time and space to complete their work. With luck we will all be able to read about the initial design at the upcoming Digital Communications Conference.

There are several ways TAPR members can participate in these long range plans now. The first is to begin learning and educating yourself about what Spread Spectrum is and how it works today. There is a lot of information on the TAPR web page (http://www.tapr.org/ss) and at your local library. TAPR supports an e-mail list for Spread Spectrum communications. Get on that list and start asking questions. There are many on there who will help Elmer those interested in the mode. If you don't think Spread Spectrum is the answer, then research other options as well. Learning and education is a lot of what technological change is about.

Second, I might be lecturing the congregation that already knows what TAPR is doing, but it is impossible for the TAPR Board and a few of the movers to handle all the questions and discussions that happen on packet radio BBS traffic, USENET, and at local meetings. It will be up to the TAPR membership to communicate what TAPR is about and defend it when incorrect and defamatory statements are made by others. It is up to the TAPR membership to educate those that don't understand or believe that new communications technologies are based on 1970s technology. Try to help disseminate the truth as you see it, and help stamp out the rumors and conjecture.

Another aspect to your involvement is to contact your ARRL Division Director and let him/her know what you think about Spread Spectrum and what TAPR is actively pursuing. You might ask why is it important to communicate with the ARRL? The last membership survey we did showed that over 80% of TAPR members supported the ARRL as members and we must acknowledge that the ARRL has a large voice in the future of what happens at the FCC, as well as several other important aspects of the hobby. Your director's representation at the ARRL board meetings can only be as good as the information supplied by their constituents. This is **YOU** if you are in that 80% of TAPR members who are also members of the league! If you think Spread Spectrum is an important future mode in amateur radio, you need to drop an e-mail, write a letter, or call the director that represents you and let them know what you think. Those that oppose the further use of spread spectrum in the hobby have already been doing this, so we had better start participating in the process or the current FCC rulemaking will conclude and we might find that we have rules that really kill the current spark of interest that has begun to kindle and might one day become a bright flame in the hobby with regard to spread spectrum communications in the amateur radio bands.

Other Organizational Issues

Don't forget that the ARRL and TAPR Digital Communications Conference will be held in Baltimore, MD, on October 10-12. Proceedings deadline for papers is August 20th! Deadline for booking your hotel room if you are flying in or staying overnight is September 9th! This is a full month before the conference, so don't put off getting your hotel room; get it now while room rates are at the conference price.

TAPR will have a booth at the ARRL National convention to be held in Jacksonville, FL, on August 2-3, 1997. Be sure to drop in and say hello to Steve Bible, N7HPR, and me; we will be working the booth. I don't think we will be presenting during the conference, but I am sure we will have plenty to discuss if you come by the booth.

At the TAPR Board meeting at Dayton, we also passed the Affiliated Groups motion. There will be a full writeup in the next issue about how local and regional groups can become affiliated with TAPR.

I want to take a second to congratulate Steve Stroh, N8GNJ, for his excellent work and effort as secretary of the organization, since he took over this position shortly after last year's board meeting at Sea-Tac, Washington.

Bob Hanson, N2GDK, *PSR* Editor is always looking for technical papers to publish in the PSR. From reading all the e-mail in the last several months, people are doing things, so please take a few minutes to write it up and send it to Bob for publication in the *PSR*.

Until next quarter!

Cheers - Greg, WD5IVD

Sumner, D. (1996, May). Is there a spectrum shortage? *QST*, p. 9. Reprinted with permission in *PSR* issue #63, p. 17.

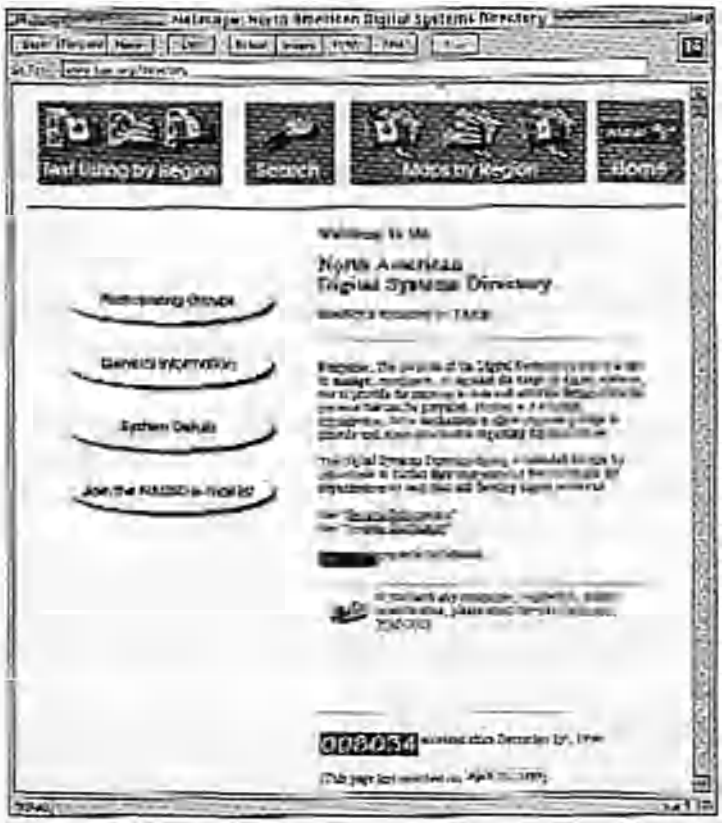
Gilder, G. (1997). Inventing the internet again. *Forbes, ASAP*, June 2nd. Web: http://www.forbes.com/asap/97/0602/106.htm

NADSD Update

If you haven't visited the North American Digital Systems Directory in the last few months, you should. The web pages have undergone a major face lift. The system now contains over 3900 entries submitted by 127 organizations in the US, Canada, and Mexico.

The system still has some work to do to get Mexico fully operational, but we expect to see that happen before the end of the summer.

The only US states/territories that do not have information being submitted include: Kentucky, Montana, Oregon, Puerto Rico, and Wyoming. There are several regions in Canada that also do not have groups representing. If you can cover one of these areas, please contact Carl Estey, wa0cqp@tapr.org



Home page of the NADSD.

The NADSD participants will begin to work toward ensuring current updates near the end of 1997 for inclusion in the 1998 TAPR CD-ROM, as well as investigating the possibility of doing a publication of the data for sale by regional groups participating in the printing.

WWV/H demodulator/decoder

Mills@huey.udel.edu

You may be interested in a DSP-93 modem program which implements a radio clock based on WWV/WWVH transmissions. It has a nominal timing error less than +-125 usec when tracking one of the stations and nominal frequency error less than +-0.4 PPM when not tracking a station. The clock produces an ASCII timecode that can be used to set the time of another device, such as a computer, as well as precision reference signals that can be used for other purposes, such as to drive laboratory test equipment.

This has been a fun project and something I wanted to do since I was a consultant to Precision Standard Time, Inc. (PSTI), when they made the 1020 Integrated Time Source, which is synchronized by WWV/H. I made rash suggestions to scrap the conventional microprocessor that runs the thing and replace it with a DSP chip with appropriately elegant demodulation and decoding algorithms. I also suggested to rely more on sophisticated signal processing, which can dig deep in the noise, and less on multiple-frequency scanning, both of these things provide better accuracy and lower cost. Well, they sold the business to Traconex before I had the chance to put the ideas in practice.

The program is no toy; the design is based on optimum receiver principles using a maximum likelihood approach and matched filter, synchronous detection and soft decision algorithms. The clock discipline is modelled as a Markov process, with probabilistic state transitions corresponding to a conventional time-of-century clock and the probabilities of received data correlated with each decimal digit as it advances. The result is a performance level which results in very low error rates, even under conditions when the one-minute beep from the WWV signal, normally its most prominent feature, cannot be detected by ear with a communications receiver.

The program produces ASCII timecodes in two formats, one compatible with the Spectracom radio clock, which is supported by the Network Time Protocol (NTP) distribution for Unix and Windows, plus another including more performance data. It also produces a number of debugging formats and various signals synchronized to the WWV/H signal. It can operate at a number of baud rates from 300 bps to 153.6 kbps. The DSP-93 front panel LEDs are intricately coded to reveal the health of the program and the various demodulation and decoding algorithms.

There are a couple of things that have stumped me so far, both having to do with the 16550 UART in the DSP-93. I have not been able to get transmit interrupts to work, which would provide better accuracy for the ASCII

timecode. Also, I have not been able to wiggle either the RTS or DTR lines to provide a precision pulse-per-second (PPS) signal to discipline the computer clock down to microseconds. A mystery remains why the matched filters for the WWV and WWVH seconds tick can't pry the two apart. Suitable mea culpae are revealed in the documentation.

The distribution containing the program source, DSP-93 binary, functional description and operating instructions, is available for anonymous FTP from ftp.udel.edu in the file pub/ntp/wwv.tar.Z. This is a work in progress and I invite anybody to monkey with the algorithms, experiment with new features and generally have a good time. Your comments and suggestions are most welcome.

Dave, W3HCF

Timewave Acquires AEA

http://www.timewave.com/aea.html

AEA Acquisition Complete!

Timewave has completed the purchase of all the AEA (Advanced Electronic Applications, Inc.) products except the antennas and antenna analyzers. Timewave will offer new product sales as well as warranty service, repair, and firmware upgrades for existing AEA products.

Tempo Research Corp. of Vista, CA has acquired the AEA antenna analyzer and antenna product lines. Contact them at 406-387-3795 (Voice/Fax).

Upgrades and Repairs

Timewave recognizes that the lack of a source for upgrade EPROMS, repair parts and factory service for older products may have caused some inconvenience to AEA customers. Setting up the factory service and upgrade facilities is Number 1 on Timewave's list of tasks.

Timewave will handle warranty service for all AEA data products, including those sold by AEA in the last 12 months, and those new AEA products currently on dealers' shelves.

Timewave will make periodic announcements about the products and services as they become available. Watch the Web page and Timewave magazine ads for additional information. Also check with your favorite dealer for information, data sheets, and catalogs as each product gets into production.

Phase 3D delayed

Space Bulletin From ARRL Headquarters

AMSAT Phase 3D officials remain optimistic despite another delay in the launch of the Ariane 502 that is scheduled to carry Phase 3D aloft in mid-September. The European Space Agency, ESA, announced this week that the Ariane 502 launch will be delayed a couple of weeks until September 30 at the earliest while the rocket gets another engine. It's the second delay announced this year for the Phase 3D vehicle. In March, the launch date was moved from early July to mid-September. AMSAT-NA President Bill Tynan, W3XO, remains philosophical about the schedule changes. "It's more of the same," he said. "We're trying to use all the time they give us productively."

Orbital Report On-Line said this week that a faulty component was detected in the liquid oxygen turbopump of the Vulcain engine due to fly on Ariane 504. Since the origin of the flaw was identified as a possible production defect and a similar element is known to be in the pump of the engine already mounted on the Ariane 502 rocket that recently arrived in Kourou, French Guyana, the European Space Agency and the launch consortium (CNES) have decided to remove the engine and replace it with the one originally scheduled for Ariane 503, which features a component from an older production batch.

Any delay increases the overall cost of the project, but Tynan characterized the additional cost factor of the most recent delay as "noise level." He did not have a precise cost estimate. Tynan, who was at the Phase 3D Integration Lab in Orlando, Florida, said everything is going along well in the process. "The RF equipment integrated fine," he noted.

For more information on Phase 3D, including pictures of the assembly and integration process, see http://www.amsat.org/amsat/sats/phase3d.html.

P3D RUDAK web page updated

Bdale Garbee, N3EUA
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Lyle Johnson, WA7GXD, sent me some digitized pictures of various pieces of Rudak undergoing turn-on and testing in his lab in late March. I just got around to updating the Rudak web page to include these pictures, and Lyle's descriptions of what's happening in each picture.

http://www.amsat.org/amsat/sats/phase3d/rudak-u/

Using the Tripmate with a KPC-3

Jack Anderson
jra@crosslink.net

[From the APRS-SIG]

After receiving several requests to send my "Tripmate to KPC-3" setup here and in private email, I decided to document my setup and post it here. Please feel free to add this to any APRS or Tripmate FAQs in existence. Much of the information listed here comes from a sig post by Bill Kearns on 12/29/96, describing the steps taken by WB6JAR, N6KZ/8 and WK5M to get it working right. I've added the little embellishments that I used to customize the setup for my installation.

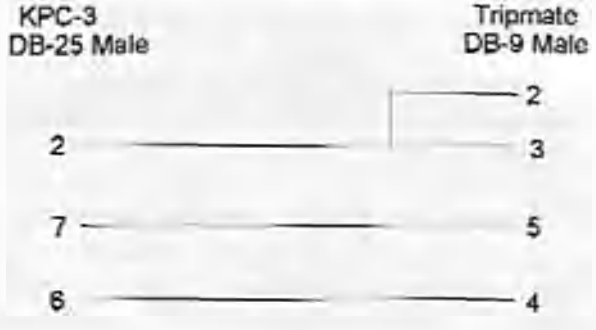
1. Install a 4.7K resistor at R48 on KPC-3 printed circuit board.

   This raises DSR on the KPC-3 RS-232 interface, which is connected to the DTR lead of the Tripmate RS-232 interface. On/off for the Tripmate is controlled by the DTR lead.

2. Build the KPC-3 to Tripmate Adapter Cable.

I used shielded DB-9M and DB-25M connectors for mine, with about 4" of shielded, 4 conductor data cable in between. Note that pins 2 and 3 in the DB-9M are connected together. This enables the Tripmate to "self start", since the Tripmate sends out the required initialization string on its TXD when powered up. The adapter cable also interfaces the data output of the Tripmate to the KPC-3, and the KPC-3 DSR signal to DTR on the Tripmate, to activate the GPS unit.

KPC-3 to Tripmate Adapter Cable



3. Configure KPC-3 for GPS operations.

Except where noted, factory default parameters are used. My personal setup:

General parameters-

```
MYCALL N4ULS-9
ABAUD  4800
BTEXT  Tripmate standalone tracker, no
terminal.
BEACON every 20 (20 mins)
UNPROTO BEACON VIA WIDE,WIDE
```

GPS parameters-

```
GPSHEAD 1 $GPRMC
GPSHEAD 2 $GPRMC
GPSHEAD 3 $GPRMC
GPSHEAD 4 $GPRMC

LTP 1 APJ3
LTP 2 APR5 VIA RELAY,WIDE
LTP 3 APR5 VIA RELAY,WIDE,WIDE
LTP 4 APR5 VIA WIDE,WIDE

BLT 1 EVERY 00:00:35 (frequent posit updates
into local stations; uses LTP 1)
BLT 2 EVERY 00:02:00 (good for local area;
uses LTP 2)
BLT 3 EVERY 00:04:25 (wide area propagation;
uses LTP 3)
BLT 4 EVERY 00:04:35 (wide area propagation;
uses LTP 4)
```

Remote sysop parameters-

```
MYREMOTE  your remote sysop alias here
RTEXT     your remote sysop password text here
```

(Remote sysop capability is a real plus. I use my home station to change mobile tracker parameters without bringing the TNC indoors to a PC. Use with caution - some commands will "break" the TNC, making it necessary to disconnect it and bring it in to software or hardware reset the unit.)

Final command, then power down unit-

```
INTERFACE GPS  (sets KPC-3 up to parse NMEA
data from the Tripmate)
```

When KPC-3 is powered on, it will come up in GPS mode, looking for the NMEA sentences preceded by the $GP* headers listed in GPSHEAD 1-4. To get the CMD: prompt back, connect a PC to the unit running 4800,N,8,1, *power the KPC-3 on and after a few seconds,* type control-C three times. Don't forget to issue the INT GPS command after you are finished to restore the GPS mode.

4. Installation

Connect the TNC to your radio using the normal interface methods for your radio model. Connect the GPS to the KPC-3 using the adapter cable described above. Connect all equipment to your car's 12 VDC power source, preferably a direct, fused connection to the car battery. Provide power to the Tripmate using internal batteries or an external power source (see Other Notes below). Place the Tripmate in a location where it has a clear view of the sky.

Power on all equipment and monitor a separate TNC and PC running APRS or a terminal program for activity. If everything is configured correctly, you should see packets timed coinciding with the BLT parameters that you set in the KPC-3. Valid position information will be

transmitted once the Tripmate has a chance to acquire locks on the visible satellites.

Other notes

My entire setup consists of a Yaesu HT, 35 watt power amp and KPC-3 mounted in a plastic carrying case salvaged from an old Canon miniature electronic typewriter. This box is mounted in the trunk. All equipment is connected directly to the car battery, and left powered on at all times (also known as "Poor Man's Lojack"). The Tripmate rides on the shelf behind the rear seat, viewing satellites through the rear window of the car. Hook-side Velcro keeps the equipment box from sliding around in the carpeted trunk, and also keeps the Tripmate in one place on the carpeted rear shelf.

I purchased the Delorme power cable set, and use the Tripmate cigarette lighter cable in the Canon plastic box to supply power to the Tripmate. This gives me a lot of flexibility if I ever need to take JUST the Tripmate out and use it in another vehicle. An alternative would be to use one of the many methods of feeding regulated +6 VDC on the Tripmate RS-232 Pin 9, and jumpering the center and (+) pins of the battery connector together to supply power to the Tripmate. Relying on battery power alone is probably not viable for a standalone tracker.

I make extensive use of the KPC-3 remote sysop capabilities to change parameters. For example, when parked in my driveway, I'll back off the BLT times to avoid dumping repetitive posit info on the busy local APRS net.

National APRS Calendar

Henry, N0WMM henryvb@dpliv.com

It was suggested by Bob Bruninga, APRSdos Author, that this calendar be maintained in a common location and be posted weekly to the APRS-SIG. Northern Illinois APRS Network (NIAN) has volunteered to maintain this list. If you have items to add to the list, send the information (date, location, event, what's happening, frequencies used, contact) by e-mail to: henryvb@dpliv.com or complete the form at http://www.geocities.com/CapeCanaveral/Lab/2809/aprscalform.html

Wed 07/23/97 - Tue 08/05/97

Fredericksburg, VA 38?N 077?W; Boy Scout Nat'l Jamboree, 35,000 Boy Scouts from all over the country. If anyone on the SIG is gonna be there, bring your trackers! If anyone else can help out, please let APR-Bob know. Contact APRBob mailto:bruninga@nadn.navy.mil MAPS of Jambo Site ftp://www.tapr.org

Sun 08/03/97

Missouri; MS-150 Louisburg Pancake Ride; Volunteers needed. 20+ stand-alone trackers, any/all MIC-E units available, plus people with laptops and ability to go full APRS mobile. Overland Park (KS) south to Louisburg (KS) and return. Contact Jim KU0G mailto:ku0g@kcaprs.org

Sat 08/09/97 "Afternoon"

Shreveport - Bossier City, LA; Shreveport - Bossier City LA Hamfest; APRS Presentation by Mike, WB5QLD. Hamfest is Saturday and Sunday. Contact Mike WB5QLD mailto:mheskett@startext.net Website http://www.startext.net/homes/mheskett

Sat 09/06/97 - Sun 09/07/97

Missouri; MS-150 Get-Away Bike Ride; Volunteers needed. 20+ stand-alone trackers, any/all MIC-E units available, plus people with laptops and ability to go full APRS mobile. Grandview MO eastward via Pleasant Hill, Kingsville, Chilhowee, Knob Noster, Sedalia and south to Versailles. Contact Jim KU0G mailto:ku0g@kcaprs.org

Sat 09/20/97

Dayton, OH; Dayton AF Marathon; Possibly JavAPRS for this event. Contact Bob Mahoney WB8CXN mailto:rgmahon@worldnet.att.net

Fri 10/10/97 - Sun 10/12/97

Baltimore, MD; ARRL/TAPR Digital Communications Conference. All-day seminar on APRS among other things. This is the conference where WinAPRS was conceived in 1995. Contact TAPR http://www.tapr.org/dcc

Fri 10/17/97 - Sun 10/19/97

Toronto, ON; AMSAT Conference
Contact AMSAT http://www.amsat.org

Sat 10/18/97

Hartford, CT; Hartford Marathon; APRS will again be used to track key elements in the Hartford Marathon. Plan includes 6 GPS Standalone Trackers with multiple APRS screens at Race Headquarters, PA Announcer and other locations. Freqs: 145.790. Contact N1QKP, Knut mailto:n1qkp@bigfoot.com Website http://dt.net/~knutf/htfd.htm

The latest information can be accessed thru the NIAN Homepage at: http://www.geocities.com/CapeCanaveral/Lab/2809

APRS Tracking the MS Walk and MD WalkAmerica

Alan Crosswell
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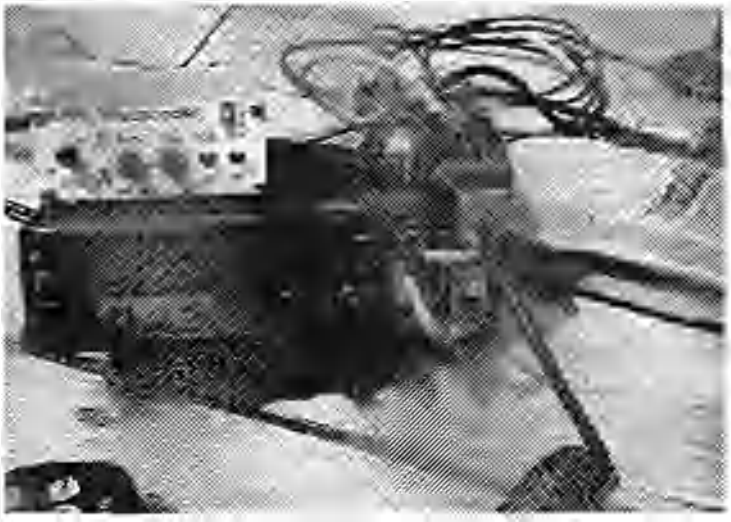
[Additional pictures can be found at http://www.weca.org/pix and www.weca.org/wcaprs.]

Westchester Emergency Communications Association (WECA) used APRS for the first time at the MS Walk at Rye Playland on April 20th, and the March of Dimes WalkAmerica in Mt. Kisco on April 27th. We only had one tracker operating in a vehicle: a beta-test model of the TAPR Mic Encoder, shown here as part of my public service go-kit, it includes:

- Kenwood TM-733A dual-band mobile,
- Dual-band mag mount antenna,
- APRS Mic Encoder (beta test model) with a Radio Shack gadget box for the various connections, and,
- A DeLorme Tripmate Global Positioning System (GPS) receiver.



For the Rye event, I rode with MED-1, one of three volunteer EMS crews from the Ossining Volunteer Ambulance Corps, OVAC. For the Mt. Kisco event, I lent my equipment to Bill Nolan, KB2YHT, as I was part of the crew up at the ENY Convention at Beaconfest where we ran APRS in the Red Cross Comm Van (along with 10-80m HF, VHF, UHF, and ATV).

To use APRS at these events, quite a bit of advanced preparation was required:

- I generated street-level detail APRS maps from US Census TIGER/Line data, using a program I wrote called tig2aprs. You can find the program at http://www.cloud9.net/~alan/ham/aprs. The maps can be found on the WECA APRS web page, http://www.weca.org/wcaprs.
- I used DeLorme Street Atlas USA to trace the planned route, exported this route to a file, and then used the list of way points to enhance the APRS street map with a highlighted outline of the route.
- I set up an APRS digipeater at home that translates the Mic-E packets from 147.06 to 145.79, the local APRS frequency. The digipeater is another program I wrote called aprsdigi.
- For the ENY Convention, Dwight Smith, N2FMC, set up a temporary 145.79 digipeater at a hilltop site near Fishkill and another at the Grasslands tower to ensure that our APRS activity would make it up to Fishkill. And, Anthony Licata, N2NWZ, brought his laptop and a VHF rig for APRS, among other things! Also, Bill put up a temporary digipeater on 145.79 at his girlfriend's house near Mt. Kisco.

On the day of the Rye event:

- I set up my laptop computer next to the NCS in the comm van, connected to the packet TNC and monitoring 145.79.
- I dropped my go kit into Pete from OVAC's 4WD (he was MED-1) and off we went. As usual when riding with Pete I had to clip on to his battery since his cigarette lighter plug was otherwise occupied with a splitter for his cell phone and Dashmaster strobe light.

What worked and what didn't:

- Using the Mic-E eliminated the need for a second radio that one would need if using a conventional TNC-based APRS tracker and the desense problems that would occur if both were on 2 meters.
- However, using the Mic-E also meant my position reports were only transmitted when I keyed up or the occassional time the frequency was clear long enough for the automatic transmissions to happen. This means the NCS generally didn't have a current position for MED-1 without first communicating with me.
- Pete's vehicle has a near vertical windshield which prevented the Tripmate from getting a good position lock. I ended up duct-taping the receiver to his roof. Bill had to do the same for the WalkAmerica when he rode in a bus.
- This was further complicated by a total lack of visual feedback from the Tripmate of whether it had a good fix or not. Like many GPS receivers, if the Tripmate fails to get a fix or loses it for long enough, it appears to require power-cycling before it will successfully reacquire. The only way to know for sure that the Tripmate had a fix was to get someone monitoring

APRS to check or to hook up a laptop computer to it — not exactly a comfortable position to be in for the person setting up a mobile tracker in a served-agency vehicle.

- We had the comm van station on 145.79, listening for the repeats of the Mic-E data. Unfortunately, 145.79 was being desensed by the 147.06 NCS transmitter and digipeater coverage into the area was poor anyway. So, the map at the NCS position missed many of the transmissions. In hindsight, we should have put the NCS packet station on 147.06 and monitored the Mic-E transmissions directly.
- When I got home and looked at the log of the 147.06 to 145.79 digipeater, it had logged many position reports. If you have a Java-capable web browser, you can see the replays at http://www.weca.org/weaprs.
- For the Mt. Kisco event, I goofed up my aprsdigi configuration so that none of the 75 or so position reports received from Bill on 147.06 made it up to Fishkill. The one or two that did, happened when he switched over to 145.79 and kerchunked the Mic-E.
- All of Dwight's hard work to get the temporary digi installed did not go to waste as Arie Booten, N2ZRC, who was running an APRS demo from inside the hamfest was able to digipeat through Anthony's station in the van and from there through Dwight's on the hill. Normally Dutchess County and Westchester County do not see each other on APRS due to a lack of WIDE digipeaters in Dutchess and Putnam. It turns out that Erik Pedersen, N2VHL, had also put his station on the air so we had a backup path.

Many of the lessons learned with the beta-test Mic-E by us and the other 50 or so beta-testers have been fed back into the final design of the production unit that went on sale at Dayton.

- The need for an ugly connector box is gone: the production Mic-E is wider and has front-panel modular and round microphone input jacks, and rear-panel modular mic out jack and an internal "personality header" jumper block for tailoring the unit for your specific brand of radio. The unit comes with a modular cable and a round mic plug that you can put on it to allow connection back to your rig.
- Positive feedback of a valid GPS fix is now indicated by a tri-color LED on the front panel. I've already upgraded the firmware on my beta model and retrofitted this feature!
- Several other tri-color feedback LEDs have been added to aid in determining the settings of the message and digi path controls in the dark.
- And about a dozen other less-visible improvements were made as well.

So what's all that junk connected to the Kenwood?

On top of the rig is the beta-test Mic Encoder. The production version looks even nicer! For a picture, see http://www.tapr.org/tapr/html/mic-e.html. The beta unit has, from left to right:

- Digipeater path switch used to select how you want your position to propogate: omnidirectional or directional, by choosing different digipeater paths (similar to the UNPROTO ... VIA command).
- Status message number switch. There are 8 canned statuses ranging from off-duty to emergency. This switch also selects conventional or special SSID digipeat mode (which results in much shorter packets but can only be used with an SSID digipeater like aprsdigi).
- AUTO switch to enable automatic position reports to be sent periodically.
- Power switch.

To the right of the rig, attached to the mounting bracket is a Radio Shack project box. On top is a master power switch for the Mic-E and Tripmate GPS. On the front are:

- Mic input modular jack, wired for my TM-733's mic.
- DeLorme Tripmate "self test" toggle switch. This loops the Tripmate's TxD back to RxD to make it hear what it wants (the same thing it keeps printing at boot up, "ASTRAL") in order to start generating NMEA-0183 GPS status strings. Opening the switch passes TxD through to the front panel DB-9.
- A DB-9 connector to plug my laptop in so I can run Street Atlas USA concurrently with the Mic-E.

Coming out the back of the project box are:

- DC Power.
- A cable with a mini-DIN that mates audio, PTT, and DC power into the Mic-E beta unit.
- A cable with a DB-9 that routes GPS data into the Mic-E beta unit.
- A cable with a DB-9 that connects to the Tripmate for NMEA data and to supply power and the "turn-on" signal. Powering the Tripmate this way eliminates the need for batteries.
- A modular cable that goes into the TM-733's mic jack.
- A mini-DIN that connects to the TM-733's data jack. I use this to get the SQC (squelch) TTL output which is high when the radio is unsquelched. This is used for the Mic-E's holdoff circuit which prevents it from automatically transmitting when the frequency is in use.

Inside the project box are:

- Mostly a rats nest of interconnecting wires and a couple of diodes between the various jacks and plugs. I used a generic drilled PC board from Radio Shack (sliced in half the long way and stood on edge) to do all the interconnections.
- A LM317T power regulator programmed to about 8.2V with a couple of resistors. This supplies power to the Mic-E and the Tripmate.

The reason I chose 8.2V is that's what resistors I had in my junk box that got me between 7.5 and 11V. Both the Mic-E and the Tripmate have internal regulators. The Tripmate FAQ on the Internet, ftp://sundae.triumf.ca/pub/peter/tripmate.faq, says the Tripmate's regulator has a maximum input power of 11V, so I couldn't just dump 13.8V in! The Mic-E uses a 7805 regulator and I wanted to leave it in line (there is a jumper to bypass it when the supply power is less than 7.5V) as extra protection for when I power the unit from a different source, such as the 9V battery I use when configuring it.

APRS Tracks

Stan Horzepa
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DCC

The 1997 ARRL and TAPR Digital Communications Conference (DCC) will be held October 10-12 in Baltimore. Steve Dimse, K4HG, the author of javAPRS has organized an APRS seminar for DCC Friday (1-8 PM). The tentative outline for the seminar is as follows:

Introduction to APRS **TBA**

Special Event Experiences **TBA**

APRS hardware/software updates
- **APRSdos update**: Bob Bruninga, WB4APR
- **Mac/WinAPRS update**: Keith and Mark Sproul, WU2Z and KB2ICI
- **javAPRS update**: Steve Dimse, K4HG
- **MIC-E/repeater update**: Gwyn Reedy, W1BEL
- **DEJe update**: Joe Agrelo, N2QQC

Hardware overviews
- **GPS overview**: TBA
- **TNC overview**: TBA
- **Weather station overview**: TBA

Panel discussion: Moderated by Steve Dimse
Panelists: WB4APR, WU2Z, KB2ICI, W1BEL, others TBA

Steve says that "this ought to be the most complete APRS gathering ever ... it's as close as we are likely to come to a national APRS meeting."

I hope to fill the first and last TBA slots depending on my employment situation, so I hope to see you all there.

Speaking of Updates

As I write this, the current versions of APRS software are DOS 7.9.4, Macintosh 3.0.1 and Windows 2.0.1.

SIG Update

Keith Sproul, WU2Z, has stepped down as chairman of the TAPR APRS-SIG in order to devote more time to the Mac, Win and UNIX versions of APRS. I have stepped up to take his place as chairman.

MIC-E Update

The TAPR MIC-E has been released.

With mobile GPS/APRS continuing to grow, MIC-E (for microphone encoder) eliminates the need for every mobile station to have a TNC, digitally-optimized radio and second antenna by simply integrating the position report into a very brief tone burst at the end of a voice transmission via any voice radio. With MIC-E, no additional hardware is required in the vehicle, other than a GPS unit. The system not only reports position and vehicle type, but also transmits one of seven canned messages and four analog telemetry values.

MIC-E provides a quick, easy means of tracking your mobile operations when properly interfaced with your existing voice radio. Before operating MIC-E on the air, you should inquire about APRS operations in your immediate area. Check 145.79 MHz (U.S.), 144.39 Mhz (Canada); some areas may also use 145.01 MHz. By contacting APRS users in your local area, you may find particular voice repeaters that already support MIC-E operations with a cross-band link to the local APRS network.

In order to make the APRS locator system practical, MIC-E has been designed with several concepts:
- Interfaces to unmodified radios via the radio microphone connector
- Uses standard AX.25 for compatibility with existing TNCs
- Compresses position report into about 0.3 seconds
- Power consumption is so low that it may be powered from the microphone jack
- Accepts the readily available NMEA output from GPS receivers
- Optionally provides four analog channels for telemetry

The result is a 1200-baud position report compressed to 32 bytes including beginning and ending flags.

The MIC-E installs between your radio microphone and radio and allows your GPS unit to transmit APRS AX.25 frames at designated intervals without a TNC!

The heart of MIC-E is a PIC chip processor that is now sold commercially by Clements Engineering (http://home.navisoft.com/agrelo/clement.htm). In 1996, Gwyn Reedy, W1BEL, President of PacComm (http://www.paccomm.com) approached TAPR about handling the amateur version in a semi-kit solution. A semi-kit means that the board has already been built, but interface wires, box, and other items still need to be configured and assembled for proper use by the owner.

The MIC-E is the result of the collaborative process begun in October 1996 and finished in May of 1997.

To support MIC-E, TAPR now sponsors a special interest group (SIG) for it. To subscribe to the MIC-E SIG, send email to listproc@tapr.org with the following one-line message:

```
subscribe MIC-E first-name last-name callsign
```

Until next time, keep on trackin'

KISS, Revisited

A Proposal for the Definition of a Secure Asynchronous Protocol

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Introduction

Most of the errors occuring during transmission of bulletins and private mail over RF links are due to character losses. While plain text contains enough redundancy not to distort significantly the meaning of a written sentence — in most cases, or to make the affected text part look like a typo, the dissemination of non-textual digital data is severely degraded. Sometimes, a character loss is only detected in the case where a Bulletin ID is shortened thus producing a dupe which will consequently be forwarded in addition to the original.

The number of character losses was reduced significantly after Jan Schiefer, DL5UE, and Dieter Deyke, DK5SG, [2] enhanced the "raw" KISS frame with an ending CRC-16. However, as will be shown, a CRC cannot replace an explicit length specification because several classes of character losses remain undetected by a CRC-mechanism.

In order to provide "HDLC-grade" security to the KISS protocol, the raw KISS frame must be encapsulated by an explicit count field at the beginning and a CRC field at the end.

Overview of KISS and SMACK

The KISS protocol introduced 1986 by Phil Karn, KA9Q, and Mike Chepponis, K3MC [1] provides a simple and convenient interface between synchronous HDLC data which has passed the SCC-barrier and is now presented as 8-bit-parallel byte-sequential asynchronous data to the PAD (packet assembler disassembler).

KISS assumes that all the hard work of bit fiddling and error checking has been done i.e. that safety precautions against bit errors are no longer needed and that no buffer overruns occur while exchanging data between TNC and PAD. Organized as an asynchronous byte-sequential stream, KISS provides means to multiplex commands addressed to TNCs into the stream of data of several packet channels.

The format of a KISS frame is:

FEND	control and data bytes	FEND

In 1990 Jan Schiefer, DL5UE, and Dieter Deyke, DK5SG proposed the following enhancement which has since been implemented in many packet programs in Europe, e.g. TF 2.7, Flexnet 3.3x, a number of European NetRom offsprings such as TNN and (X)Net/3-Net, etc.

The format of a SMACK (Stuttgart's Modified Amateur CRC KISS) frame is:

FEND	control and data bytes	CRC	FEND

DL5UE and DK5SG's modification to the KISS frame is convenient in so far as the enhanced protocol maintains a high degree of compatibility with the original KISS specification.

Before we continue to investigate the immunity of KISS frames to transmission (or programing) errors, it is useful to look back to the basics and appreciate the brilliance of the ideas underlying the original definition of HDLC.

A Look at an HDLC Frame from the Data Security Point of View

The roots of the HDLC protocol go back to the time when the predominant means of recording digital data was on magnetic tape. These digital tapes, although checked out carefully, sometimes had the unwanted property of small inhomogenities in their magnetic coating which led to bit errors when the data was being sampled afterwards.

A block of data or "record" is defined as a number of data bits delimited or "framed" by a sync pattern which was called a "tape mark." The format of a magnetic tape record is:

TM	data bits forming the record	CRC	TM

With a parity bit added to a record of data it is only possible to detect half of all possible errors. Therefore, a more powerful error detection scheme had to be found, and this search succeeded in the introduction of the ubiquitous CRCs and other even more potent mechanisms.

In a synchronous link, the role of the tape mark is taken over by a unique bit pattern called "flag." It is used as a delimiter to separate one "frame" of data from another. The addition of the CRC as a "generalized parity string" enables the reader to detect any burst error up to the width of the CRC string.

The format of an HDLC frame is:

Flag	control and data bits	CRC	Flag

A CRC-16 is capable to identify all error bursts up to a width of 16 bits. According to this definition it is not possible to have two burst errors in a frame because the burst entails all bits including the first and the last bit error, and all bits in between.

You may also conclude that any burst error not detected by a CRC-16 must involve at least 17 bits or three

consecutive bytes. (All error bursts not detected by the CRC are multiples of its "generating polynomial," hence their length must be at least 17 bits.)

Magnetic tape records and frames of synchronous links have one important attribute in common: Their "physical" length. The length of a record on a tape can be measured in millimeters or inches. The length of a frame may be measured in time, although this cannot be repeated analogous to re-reading a tape record, more than one receiver may read a synchronous frame and decode it in parallel.

Implicit length makes a cardinal difference between tape records and synchronous frames on one side and asynchronous blocks of data on the other. Asynchronous frames have no length specification except, eventually, an explicit count subfield as part of the data field.

99% Is Not Enough

An argument encountered quite often in discussions about protocol questions is, whether one should not be content, if a certain error can be avoided in 99% of all cases. If only a single link in Europe or the U.S. would be affected, nobody would care and we could lean back. But if we are talking about protocols, then all links are affected at the same time which use that software, and then the error propagation is exponential which means:

Num. of Links	Reliability of Chain
1	0.99
100	0.366
200	0.134
400	0.018
1000	0.000043

With 1000 links, an average of 10 links fail at a time, so there are few chances for success!

There is nothing special about a packet which has travelled over more than 1000 links, is there?

For the purpose of protocol definitions, don't give in until 100% of your requirements are met, and this means zero errors within given specifications. There are some error classes, burst errors and missing bytes, which must be eliminated completely.

It is important to remember that by looking at the image of a KISS frame there is no way to tell whether an error has occurred or not. KISS in its original definition relies on the assumption, that the processors involved always possess sufficient computing reserves so that a buffer overrun can never occur. But we are radio amateurs and experimenters, and it is one of the thrills of our hobby to attempt to push the performance of our equipment and try to find its limits. Sometimes we push it beyond its limits, and then, occasionally, bytes disappear and new BIDs emerge.

So, don't forget: Synchronous links inherently cannot lose bits nor bytes! The FCS in the HDLC frame makes sure that all burst errors are detected up to a width of 16 inclusive, which means that byte contents cannot change in any AX.25 frame! And both work in practice. (Millions of internet users would complain otherwise!)

Errors Undetected by SMACK

As shown above, CRC applications with magnetic tape records and synchronous links all have one important prerequisite:

The number of bits or bytes in a record or frame is exactly known beforehand. Only if you know the length of the frame or record, then you can apply a parity check matrix like a CRC.

Conversely, the CRC as a method of checking the length of a frame is not suitable. The proof is quite easy.

Example 1:

Suppose in a frame there is a string of zeroes, and by chance the contents of the CRC-Register are also zero.

```
CRC1=0                    CRC2=0
... 0 0 0 0 0 0 0 0 0 ...
```

Parity Bit and CRC Error Detection

A detailed treatment of the concept behind the Cyclic Redundancy Check (CRC) is beyond the scope of this paper and worth a separate tutorial, or look in a textbook on Coding Theory or mathematics. Instead, we'll try to get along with some of the more obvious properties of parity bits and check algorithms employing CRCs.

The parity bit provides a very powerful tool at very little cost. 100% detection of all errors involving an odd number of changed bits, unfortunately, you don't detect any errors involving an even number of changed bits. You can think of the parity bit as an application of the "smallest CRC", a CRC-1, with the "generating polynomial" 01B. So, when dealing with numbers, you restrict yourself to using only half of all possible numbers as legal numbers, either the odd, or the even. What you gain with this trick is, that the next or neighboring legal number is different from the first one by 2 bits, or 4, 6, etc., in other words, by M bits, where M is always an even number.

How wide is the smallest error burst, which you cannot detect when you are using a parity bit? Yes, it is two, at least two bits must be different between two legal numbers, and the closest are two "1"s: 011B as difference. This method can be generalized. If you decide to look at one quarter of all numbers as legal, and three quarters are illegal or erroneous, then you gain further security. The price you pay is, your numbers or bitstrings will get longer by two bits this time. These two bits are called the redundancy you add, and the reward you get is that the smallest error burst you cannot detect with this CRC-2 is now already three bits wide.

The CRC-16 which is used in the CRC generators of USARTs and SCCs is a further implementation of the same idea, also called parity check matrix. By adding 16 bits of redundancy you make sure, that the smallest burst error undetected is 17 bits wide.

It is well known, that — if the CRC-Register contains zero — while processing the substring of zeroes the contents of the CRC Register will not change.

Therefore, you could take out or put in as many zeroes into this substring as you like, without affecting the final CRC of the frame. Or, in other words: the CRC, under these circumstances, is insensitive to any changes of its length.

This example holds for CRCs of any width, CRC-16, CRC-32, etc.

Example 2:

The CRC-16 is a 16-bit number with 2**16 possible values. Take the following substring with an arbitrary starting value in the CRC register:

```
CRC=CRC1          CRC=CRC2
  ...    NUM-16    ...
```

Now, with an initial value of CRC1, after processing NUM-16, the CRC generator will produce CRC2.

There is exactly one NUM-16, where CRC1 and CRC2 will be the same, so you would not be able to notice that NUM-16 had disappeared from your frame, nor would you be able to detect that NUM-16 had been replaced by multiple occurrances of the same number. Even worse, there are two different NUM-17s which could replace NUM-16 with no change in the CRC-Register after processing the substring.

This example also demonstrates that a CRC is not suitable to detect changes of string length.

The Secure KISS-Frame Proposed

The solution out of the dilemma described in the previous section seems quite simple:

COUNT the number of bytes and put this number in front of the data.

We would now have the following format:

Flag	length	control and data bytes	Flag

Well, there may still be one type of problem:

Example 3:

Suppose we have the following frame (assuming a 2-byte length field):

Flag	0x08 0x00	0x06 0x00 ...	Flag

If we'd lost the length indicator "0x08,0x00", then the frame would still look ok! How can we avoid this?

It is here that we re-introduce the CRC and arrive at the final layout of a secure KISS-frame with the additional specifications (assuming a CRC-16):

1 - Initial value of CRC-Register = 0xFFFF

2 - Length as 2-byte-number, least significant bit/byte first.

3 - The field "control and data bits" corresponds to the contents of the original KISS- specification [1].

4 - CRC, LSB first.

Flag	length	control and data bits	CRC	Flag

Conclusion and Summary

We have seen that the security of an HDLC (AX.25) frame critically depends on its implied length definition. A unique Frame Check Sequence can only be produced for frames of known length, of course.

Now, we are able to define three essential properties of a safe protocol for an asynchronous link:

(1) - Entities of data transmission, "frames", must be separated from one another by a unique delimiter, "flag" or "END", so that the scope of the integrity check can be clearly defined.

(2) - Each frame must have a length attribute, either implicit as physical length of tape or time, i.e. number of clock pulses, or in case of asynchronous processing an explicit count field specifying length.

(3) - The integrity of the frame contents must be verified with an error detecting mechanism, usually a CRC.

We see that the original specification of KISS falls short of (2) and (3); you can only hope that no error will occur.

SMACK falls short of (2); it is not possible to check the contents of a frame without knowing its length, or vice versa.

The many varieties of the so-called BIN, BoxBIN, or AutoBIN protocols used by German BBSs and many Terminal programs fall short of (1). The "BIN" protocols specify length and a CRC, but when a character is lost by a UART overrun for instance, the receiving program might wait forever or until timeout, or, if there are additional characters, the receiving program could crash or produce silly and unpredictable actions.

References

[1] Karn, Phil, KA9Q; Proposed "Raw" TNC Functional Spec, 6.8.1986; Available in many UseNet news archives.

[2] Grossmann, Dietmar, DJ4RX; Fehlerbehandlung von Kodierprogrammen, 1991-04-12, BID S124111DB0GV

[3] Schiefer, Jan, DL5UE, Deyke, Dieter, DK5SG, The SMACK Protocol, Protocol Version 1.0, (27 February 1992)

Packet Radio in Education: Integration of Amateur Radio and Packet Radio into a Long-Term Rehabilitation Facility

Shannon Leach

This is the eighth of several articles appearing in the PSR concerning amateur packet radio and its potential in K-12 educational applications. These papers were assembled over several summers of teaching a graduate level course at the University of North Texas. Many thanks to the Texas Center for Educational Technology for allowing TAPR to reprint this information. As part of TAPR's goal in education, we hope that these articles will be disseminated to a larger group that can take the concepts and ideas to a next step or final application implementation. If you have a teacher or educator as a friend, please pass these articles along.
—Greg Jones, WD5IVI)

Reprinted from:

Jones, Greg (ed). Infusing Radio-Based Communications Tools into the Curriculum. Texas Center for Educational Technology. 1995. 136 pages. http://www.tcet.unt.edu

Rehabilitation facilities or units are designed to assist patients in developing the skills necessary for the optimal level of function within the limitations of their particular disability. Some units or facilities are directed toward a specific patient population such as those with orthopedic or neurological diagnoses. Other units have a much more diverse patient population which may include amputees, burns, rheumatic disorders and general wound care. Regardless of patient population, all rehab units provide a multidisciplinary approach to patient care. These may include any or all of the following: Physical Therapy, Occupational Therapy, Speech Therapy, Recreation Therapy, Psycho-social Therapy, Social Work, and the overall supervision of a physician. Recreational therapy specifically works with patients to develop leisure activities. With the new no-code Technician license and the versatility of packet radio, almost anyone with any physical disability will be able to communicate with the world.

Patients with a traumatic or sudden onset of neurological dysfunction may find this especially appealing. The two most common types are spinal cord injuries(SCI), and cerebrovascular accidents(CVA).

The SCI patient is generally classified by the location of the lesion in the spinal cord. Those patients with lesions which affect the sensorimotor functions of the upper extremities are referred to as quadriplegics, while those patients with lesions not affecting the sensorimotor functions of the upper extremities are referred to as paraplegics. The actual deficits are unique to each patient, depending on the location and severity of the lesion, however, generally speaking there is a definite loss of sensorimotor function. Cognitively, the SCI patient usually retains all mental abilities available prior to onset.

There are basically three types of CVAs. Intracranial bleeds with variable causes, the formation of an embolism within a vascular structure, or the thrombus or blood clot which travels to a vascular structure within the brain. The intracranial bleeds generally lead to a comatose state from which the patient does not recover. The other types are usually less likely to be fatal, but the deficits in this patient population generally include either hemiparesis or hemiplegia contralateral to the site of injury. So, if the CVA occurs on the left side of the brain, the deficits will normally occur on the right side. Also, a patient with a left CVA will usually have more problems with speech because the speech centers are primarily located on the left side. They will usually regain a portion of their speech skills because there are some speech centers on the right side. Cognitive problems are quite likely to occur and may be very subtle.

In addition to the sensorimotor deficits and the possibility of decreased cognitive abilities, both groups of patients will be going through a psychological process very similar to patients with a terminal illness. In a sense, the person they recognized as self has died and they must rediscover themselves. The usual patient profile for an SCI is male, aged 15 - 29 and very likely to be inclined toward physical activity. This particular age group is also likely to have a high degree of self connected to body image. The patient will usually have more difficulty redefining the self in relation to the reduced capabilities of the body. The patient population for the CVAs is quite different. Usually, these patients are over 55, less active, and have had prior health problems. They are not so much concerned with body image as with being independent, although they will still have to consider their decreased abilities.

Packet radio used in conjunction with Recreational therapy can provide increased communication for patients with the appropriate level of cognition. Patients can download information from satellites, send messages around the world and into space with both the MIR cosmonauts and SAREX (Shuttle Amateur Radio EXperiment). This can greatly expand horizons for patients who may have few other ways of communicating. In addition, the ability to learn a new skill that is not connected to the disability can improve the patients psycho-social outlook. Packet radio has the ability to allow the disabled to enter a new activity where the disabilities are not a factor.

Packet radio is a method of communications which allows the user to transmit information over the computer via the radio. A packet radio station is comprised of a computer with a TNC box, a ham radio and an antenna. With the addition of a microphone for the radio and a voice input for the computer, almost any patient who is cognitively able can use the packet system with either a voice input or a keyboard. Also available for those who choose to learn it, is Morse Code, which would be excellent for the aphasic patient with limited hand movement.

The cost of a ham radio/packet radio system and the addition of equipment required for voice input would cost approximately $7500. Compared to other pieces of medical equipment, this is moderately priced, and other than the initial expenditure there is no monthly fee, only the cost of maintenance. The person operating the station should be licensed, and now this is available without learning Morse Code.

With packet radio available through Recreation Therapy, many patients who are feeling closed in because of immobility inherent in some disabilities could discover a new activity which would be them in with the world. Others can use this as a new outlet for previous activities they can no longer participate in. Packet radio is a rapidly developing technology with much to offer to people with disabilities.

HF Modem Testing

Johan Forrer, KC7WW
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There is some HF modem testing activity currently underway. Here is some information on those tests.

BPSK

1) With a group of amateurs monitoring in the UK and the Netherlands using sensitive narrow-band signal detection software, the KC7WW beacon that operated on 14070 (carrier) was not detected. I guess if there is no propagation, there is no signal to work with, regardless of what you do. The experiment will now reverse direction with PA0HD transmitting a beacon for a week on 14070, so this is an opportunity to see if we succeed this time.

Several reports were received from US amateurs that heard the KC7WW beacon. This is good news - if you can hear the signal, your copy will be excellent. Also, several are in the process to get their EVM interfaces sorted out. Just a reminder, to do slowspeed BPSK with the EVM, you do not need an elaborate interface - just pipe audio to and from the EVM and put your radio in VOX mode. Be careful to turn your power output way down because this is 100% duty cycle and you do not want to burn out your finals.

2) I have had good success with the VE2IQ Coherent software to print BPSK traffic. Signals from the west coast are very strong here and copy is 100%. I also managed to copy about 5% from VE2IQ - a signal that was there once you knew what to listen for. If this was CW, it would have been nil copy for me - I am impressed.

To participate in this project, you need to build simple sigma-delta A/D convertor that plugs into your serial port. The hardware was featured in QST some time ago, however, the schematic for the A/D and BPSK and software is available for downloading from VE2IQ's web page: http://w3.ieto.ca/home/bill/bbs.htm

I have uploaded a package containing the DSP source code and notes on how to use the EVM as a front end for the VE2IQ, "COHERENT" BPSK program. This is a somewhat advanced project, so see it as a challenge - OK? Please look for COHEVM1.ZIP in the TAPR DSP recent_uploads area:
ftp://ftp.tapr.org/tapr/SIG/DSP/recent_uploads/COHEVM1.ZIP

The VE2IQ software allows one to set your symbol length to any 1.5ms multiple - basically you need to acquire an integer number of 800 Hz audio cycles. So any symbol length from say 5ms to 1000ms would be possible. The longer the symbol time, of course the narrower and more critical tuning-in procedures become. We played with 30ms and 25ms symbols on 40m that seemed to work very well. This software is quite useful for several kinds of weak signal work; EME and HF are good possibilities. Unfortunately, none of these settings are compatible with the EVM-based BPSK work — that needs 32ms symbols, which is not a multiple of 1.25ms. I do have good intentions to modify the EVM BPSK code to do that, but only when and if I get the time (no promises).

Parallel-tone 3000+ BPS NEWQPSK

3) I have had only two responses to a call for participation. One from the U.S. and one from Finland. This modem needs good signals (ca. S6), so our chances to make it to Finland is quite slim, but we decided to monitor the CW beacons and see when there is an opening.

The situation with the U.S. with testing this modem is a bit dissapointing. I have heard about the need for such a high speed CSMA modem - here it is folks! Where are you?

We still are in need for participants in testing these modems, please e-mail me if you are interested. These are really fun toys to play with.

About DGPS — a tutorial

Dr. Thomas A Clark, W3IWI
clark@tomcat.gsfc.nasa.gov

There were a number of questions asked about DGPS both on APRS-SIG and at Dayton. Let me try to answer most of them at once.

First, some comments on Selective Availability and DGPS. The main function of the GPS satellites is to serve as a clock, and the satellite derives all its signals from an onboard 10.23 MHz atomic frequency standard (Cesium, with Rubidium backup). The main GPS signals that you, as a user are concerned with are on the L1 L-band carrier at 1575.42 MHz (=154*10.23). Each satellite transmits a spread-spectrum signal with a unique pseudo-random code (the PRN number you see for each satellite) 1023 bits long, sent at a rate of 1.023 megabits/second. Therefore each code bit represents a time mark every ~1 usec corresponding to a distance ~300 meters. The sequence repeats once per millisecond, corresponding to a distance of 300 km and is called the C/A (Coarse Acquisition) code.

Every 20th cycle (= 1/50th second) the C/A code may change phase and is used to encode a 50 bits/sec data message as well as serving as a 6000 km range marker (note that 6000 km is approximately one earth radius). The 50 bps data is used to encode a 1500 bit long message which contains (among other things):

- The current GPS date/time and the GPS-UTC correction
- High accuracy ephemeris information to locate the satellite
- Information on the current offset and rate errors for the atomic clock
- Low-accuracy "almanac" data on all the other GPS satellites
- A crude estimate, based on solar flux, of ionospheric delay corrections

Your receiver makes a time "hack" on the code timing data for each of the GPS satellites in terms of its local (cheap) crystal oscillator clock and in its carrier phase tracking loop it measures the apparent frequency of each GPS satellite, these are usually called the pseudorange (PR) and pseudorange rate (PRR) (although the PRR is sometimes also called the apparent Doppler offset). The PRs are typically measured to a few percent of the 1.023 Mbps (~300 meter wavelength) C/A code — i.e. at the 10 meter or better level. The PRRs are typically measured to a fraction of a Hertz (corresponding to the Doppler shift for a speed ~5 to 10 cm/sec = 0.1 to 0.2 miles/hr).

Your receiver then applies all the geometric corrections (from the GPS ephemeris message) to account for the satellite's position and apparent velocity (including both the satellite's motion and the earth's rotation on its axis). By using the PRs and the geometric data from at least 4 satellites, we can determine our 3-D (Lat/Lon/Hgt) and the time error in our receiver's clock. Similarly 4 PRRs and the satellite clock time-base error data (again taken from the message data) can be used to find our 3-D vector velocity and the frequency error in our receiver's local oscillator. Because the geometry is not perfect, the uncertainty in determination of position and speed is poorer than the individual measurements. Your receiver produces parameters called PDOP (Position Dilution of Precision), HDOP (H=horizontal) and VDOP (V=vertical) as a measure of how the observing geometry is spoiling your measurements. a PDOP=2 means that the position is a factor ~2 worse than the accuracy of the individual PRs.

The measurements are never perfect for other reasons. The receiver has an intrinsic noise level, there are errors in the ephemeris data, the signal from the satellites is delayed as it passes through the earth's ionosphere and troposphere, etcetera. And the U.S. Dept. of Defense (DoD) has invoked (by nasty effect called Selective Availability (SA).

The major SA effect comes from the fact that the satellites have a phase shifter (the electronic equivalent of a line stretcher) in the output of the 10.23 MHz atomic frequency standard, and the clock signal is dithered with a secret pseudo-random sequence. On long time scales, the SA dither averages to zero, we have experimentally measured SA's power spectrum and find that it is band-limited in the range from a few seconds to ~1/2 hour. The DoD "guarantees" that the rate of change of the SA modulation will be slower than ~1 mile/hour so that the speed you derive from the PRRs isn't too badly affected. And we have found that the SA modulation has no coherence between the different satellites in view.

The "secret" DoD user has special hardware that produces the clock corrections corresponding to the SA modulation. The "secret" user applies these to the observed PRs and PRRs before munching on the data to produce positions and Voila! the nasty effects of SA are removed. The small "secret" user still loses quality because of the other errors mentioned — especially inaccuracies in the broadcast ephemeris and propagation errors imposed by the troposphere and the ionosphere.

Here is where the smart civilian users can defeat the DoD and make SA irrelevant. Set up a high quality GPS receiver at a fixed location. Fix its position to an accurately surveyed value. Observe all the satellites that other users in the area will be using but don't solve for position — instead, you derive all the PR and PRR

differences from that for your perfectly determined positions and transmit these errors by radio. This process has been dubbed Differential GPS (DGPS).

Note that the PR and PRR errors that the DGPS base station transmits have all the SA corrections (the same ones the "secret" user would have derived) plus the ad hoc corrections that account for errors in the GPS message ephemeris and those due to the earth's atmosphere.

The corrections are "valid" for ~50 miles around the base station corresponding to the region where the atmospheric and geometric corrections are (nearly) identical. With high-quality DGPS signals from a base station 10-20 miles away, feeding a good user GPS receiver every few seconds, performance as good as ~1 meter can be achieved (as contrasted to ~10-20 meters if the DoD turned off SA). The DGPS performance is BETTER than can be achieved by GPS alone!

Keith, KF4BXT asked:

> Would you, or someone, be willing to explain the "mechanics" of using what you described? Try not to get too technical please. Specifically, how are the corrections transmitted, received and applied to my combo GPS/TNC/Computer/APRS/Radio config or I mean configuration" :-)

Well, the signals have to be available from somebody's base station in your area. Here in the Balto/Wash area, I am transmitting DGPS beacons every 20 seconds (not really often enough, especially since the radio links are often marginal) on 145.79 APRS frequency. All that the local users have to do is to poke the 4800 bps RS-232 data from their TNC into the DGPS RS-232 input connector on their GPS receiver. The APRS code provides a path so that the DGPS beacons addressed W3IWI-13DGPS can be passed through to the receiver. Or you can just use an RS-232 "hardwire" connection. The W3IWI-13 site is using a professional GPS receiver (Trimble 4000SSE, costing ~$25000) hooked onto one of the L-band power splitter ports I have at my "CODE" IGS (International GPS Service for Geodynamics) site. The SSE produces RS-232 DGPS outputs which serve as the "professional – amateur" interface. On the amateur side is a PK232 TNC and an IC2T radio of mine.

Elsewhere in the U.S., DGPS bits are available "free" on ~300 kHz supplied by the US Coast Guard. Click the DGPS button on their web site at
http://www.navcen.uscg.mil/
for more details; their web site included coverage maps to answer Roger, KB9LBU's question about northern Illinois.

There are two commercial suppliers of DGPS signals — DCI (Digital Corrections Inc.) and AcquPoint. DCI's president is an amateur and he monitors APRS-SIG and may want to inject some additional comments). They both deliver their bits on subcarriers on local FM radio stations (DCI = RDS format, AcquPoint = pager format) and are available almost anywhere in the USA (and DCI has partners in many foreign countries). You buy their special receiver and then you subscribe to the DGPS bits. DCI can be found on the web at http://www.dgps.com/ with North American coverage data available at http://www.dgps.com/north.html. I can't seem to locate AcquPoint's presence on the Web.

Regarding the ~300 kHz DGPS receivers. The signals are 50/100/200 bps MSK signals. Some amateurs have tried to hack a homebrew receiver, but I don't know of any successes. Two companies that I know of are selling small, board-level "OEM" DGPS receivers.

+ Pacific Crest
+ CSI (see http://www.csi-dgps.com/sbx2.htm)

Modular receivers can be seen at your local boat store and cost in the $400-500 range. Also see Starlink at http://www.starlinkdgps.com/.

Regarding amateur efforts: The Motorola ONCORE receiver now being offered by TAPR can generate DGPS signals and costs (for members) $260. The ONCORE's DGPS corrections are in a Motorola proprietary format (not the standard RTCM SC-104 FORMAT !!) but the format is well documented and contains all the important information included in the RTCM SC-104 spec. There has been some discussion of using either an antique PC or a small microprocessor (e.g., PIC, 68HC11) with two serial ports to reformat the data into RTCM format. Folks have suggested (and I don't want to get into the "Is it legal?" jailhouse lawyer game) that a group might purchase one ~300 kHz Coast Guard DGPS receiver and retransmit the bits on amateur channels. [Or maybe DCI could have their arm twisted to be cooperative.] Otherwise, if you have access to a high quality commercial DGPS base station receiver like I did, it only requires plugging a TNC/radio into the receiver's RS-232 port.

Hope this helps.

APRS Internet Domain

Steve Dimse, K4HG
k4hg@tapr.org

The domain aprs.net has been registered and points to the Miami APRServe machine.

`http://www.aprs.net`

I am willing and able to issue third level domain names to anyone with a static IP address. For example, wu2z.aprs.net is the Rutgers APRS machine. Email me if you are interested.

If you have a dynamic IP address, check out

`http://www.dynip.com`

for a way to have a named address. (I am writing the Mac client, and between that, setting up the APRServe nameserver, and getting the domain registered, I now know far more about DNS than I want!)

Dayton 1997

Greg Jones, WD5IVD

Dorothy Jones, KA5DWK, Bill Reed, WD8ETZ, and Sharon Reed, working the TAPR booth.

Dayton HamVention 1997 was a blast!!! It was great fun to have so many people working, presenting, and sharing ideas at this year's convention. As long as I have been attending Dayton, this was one of the best in that respect. Thanks to all those who took time out to work the booth, stuff MIC-E boxes for kits to be sold, answer all those multitude of different questions asked every year, and generally participated in being at the HamVention doing digital stuff. Dayton is fun, but is a lot more fun because of the activities involving others that happen during the weekend.

Steve Bible, N7HPR, John Koster, W9IOD, Dewayne Hendricks, WA8DZP, and Barry McLarnon, VE3JF in front of the TAPR booth.

TAPR Digital Forum

We were all very surprised to find that the digital forum had been moved from our normal 75 person room to room #1 which held 400 people! While it looked like attendance to the forum was down from past years, the number of people attending averaged between 125-140 for the entire day of presentations. I think Tom Clark, W3IWI, summed it up correctly when he stated that "he enjoyed the spread spectrum love-in happening in room #1." You could tell what the movers within TAPR have been focusing on in the last year by the presentations of materials during the forum — spread spectrum being a dominate focus. John Ackermann, AG9V, did another fine job this year in organizing the speakers and moderating the forum. Thanks to Mel Whitten who brought the projector system.

Max Ackermann, AG9V, TAPR Digital Forum moderator

Jim Neely, WA5LMS and Tom McDermott, N5TG with Jan Bible, KE4TAC, in the background.

We had planned on having a live SS link between the forum room and the TAPR booth, but Murphy struck at 9am on Friday as we were setting up. A power surge zapped the computer. We then scurried around and located a replacement mother board for $65 and when we got that installed and operating we discovered that the hard drive had been creamed as well. Oh well! We had a pair of SS radios easily talking across the HamVention arena areas and could have provided a live link back for audio and done some of the other interesting things planned - like live video, etc. Something to work on for next year. With luck, we will have our own radios doing this and won't have to depend on commercial radios for the chore. We did prove that SS worked just fine in the RF hell that Dayton presents to many a radio front end.

Tom Clark, W3IWI and Doug McKinney, KC8RI, show the TAC-2 (left) and the Omoare VP interface board (right).

We did capture all the audio from the presentations and will be making the audio and overheads available on the TAPR web page as soon as I have time to get all of it captured and encoded. Keep an eye on the TAPR home

page or the virtual meetings page. We should also have lots more photos available on-line, and in color too.

ARRS Group at their booth.

Besides the audio and photos we took, I did several QuickTime VR (Virtual Reality) movies. I have two of them stitched and I am working on the third. This was the first time I had used the camera jig to take the 360 degree panoramic photos, so I still have some work to get them looking perfect; however, it is pretty neat to see the HamVention main arena in 360 degrees as well as the TAPR forum, and just in front of the booth.

TAPR Banquet and PacketBASH

The third annual TAPR Banquet and PacketBASH was held for the second time at the NCR facilities. What a great place! We had 112 people attend, which was a 10% increase from last year. If you didn't make it this year, then I hope to see you and others again next. Many thanks to John Ackermann, AG9V, and Fred Peerenboom, KE8TQ, of the Miami Valley FM Association for their support of this event.

Tom Clark, W3IWI, presenting at the banquet on Saturday night.

Tom Clark's, W3IWI, banquet talk was entitled "Amateur Radio 2000 A Retrospective View of the Future." Tom made several very good points as to where amateur radio has been and where it is going. At the end, Tom had gotten so many stirred up about some of the issues, he opened the microphone up to the floor and what followed was an interesting debate among many of the diverse participants at the banquet. You'll have to listen to the audio to judge for yourself what was said and weigh the various positions.

Thanks, Tom for an excellent banquet talk.

TAPR Spread Spectrum STA Renewed

The following letter was submitted to the FCC regarding renewal of the TAPR STA. The TAPR Spread Spectrum STA renewal was granted before the original STA had expired. In addition to submitting the request for renewal, the TAPR SS STA participants submitted an 80 page report on activity. This report can be found at http://www.tapr.org/ss/tapr_sta.html. The STA holders, Greg Jones, WD5IVD, and Dewayne Hendricks, WA8DZP, are currently reviewing all the STA participants' activities and working on setting goals during this second period of the STA.

April 28, 1997
Mr. William Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Re: Tucson Amateur Packet Radio Corporation
Request for Renewal of Special Temporary Authority

Dear Mr. Secretary:

On November 6, 1996, Greg Jones (WD5IVD) and Dewayne Hendricks (WA8DZP) (collectively, "Applicants") were granted special temporary authority ("STA") for a period of six months to allow members of the Tucson Amateur Packet Radio Corporation ("TAPR") to conduct an experimental program involving the use of Code Division Multiple Access spread spectrum emissions (see attached). For your information, the attached report outlines the findings of the study complied to date.

The initial six-month period of the TAPR STA ends May 6, 1997. In accordance with the original terms of the STA, the TAPR program is on-going. consequently, the Applicants respectfully request renewal of the TAPR STA, for an additional six months period, with respect to the same set of amateur radio stations for which the original STA was granted.

Questions with respect to this matter should be directed to the undersigned.

Sincerely,

Greg Jones
WD5IVD (Advanced Class)

cc: David E. Horowitz

TAPR's Comments and Reply Comments to FCC Docket 97-12

TAPR filed comments and reply comments to FCC Docket 97-12 regarding the amendment of amateur service rules to provide for greater use of spread spectrum communication technologies. As with the complete rulemaking process of RM-8737 and now Docket 97-12, TAPR has tried to make all comments and reply comments available to those that can't get copies directly from the FCC. All of the comments and reply comments that TAPR has can be found at: http://www.tapr.org/ss/rule_changes.html. If you have web access, please take a few minutes and read what the ARRL and others have filed regarding the rulemaking process on spread spectrum.

In the Matter of WT Docket No.97-12 (RM-8737)
Rules to Provide For Greater Use of Spread Spectrum Communication Technologies

Comments Of
Tucson Amateur Packet Radio Corporation

Discussion

TAPR generally supports the proposed rule changes the Commission makes in its NPRM. Spread Spectrum ("SS") technology has not made great advances in the amateur radio service since it was first permitted in 1985, in part due to the fact that, by today's standards, the Part 97 regulations on amateur SS are extremely restrictive. In particular, the small number of fixed spreading codes permitted under Section 97.311(d)(1) inhibits the use and development of SS by amateur radio stations. TAPR believes that it is in the public interest, and in the interest of the amateur radio service, to change the rules for SS in order to accelerate the adoption of SS by the general amateur community.

TAPR in general supports many of the specific rule change recommendations made by the Commission.

First, TAPR supports the Commission's proposal to modify Part 97.311(b) as it pertains to the unintentional triggering of repeater inputs. This provision is redundant when considered in relation to the existing sections in Part 97 which deal with how interference should be treated and handled. This single provision alone has been a subject of concern for some time to members of the repeater operator/owners community and rightly so.

However, for this same reason TAPR feels that the proposed wording of this section puts an unnecessary burden on those who choose to utilize SS emissions. After being authorized as a legal emission mode in the service for over fifteen years now, it now seems inappropriate to continue to single out SS to be considered secondary to all other allowable emission modes authorized in the service. We therefore ask the Commission to strike the proposed section 97.311(b) in its entirety. The Commission's rules in this area should go no further than to set a maximum transmitter power output level and to set limits on spurious emissions outside the amateur radio bands.

Second, TAPR supports the Commission's decision to delete sections 97.311(c) and (d), in order to permit SS emissions and spreading codes that are not currently authorized. Elimination of the rule that dictates specific spreading codes is necessary to facilitate further experimentation and deployment of SS technology in the amateur radio service. In particular, the removal of the provision that restricted the use of hybrid SS emissions will open up potentially new areas of interesting experimentation that have not been allowed for over fifteen years now.

While, as noted above, TAPR agrees with many of the Commission's proposed rule changes, it disagrees with a few of the proposed changes contained in the rulemaking.

First, TAPR does not agree with the proposed automatic power control provision of section 97.311(g). Although TAPR supported the ARRL proposal for this provision in the comments and reply comments that it filed in RM-8737, it no longer feels that this provision should become a part of the rules governing SS emissions. Further discussion and experimentation that has taken place since the petition phase of this proceeding has convinced TAPR that the implementation of this provision would impose a serious handicap on the future development of this emission mode. While TAPR agrees that technically it is simple to control the output power of a transmitter, it is quite another matter to make this control automatic and foolproof over the wide range of applications and uses that are common today in the service. For instance, the implementation of this provision would make it impossible to use SS emissions in the point-to-multipoint packet radio networks that are common in the service today because it would be difficult to transmit a single packet which would not exceed the Eb/No level at the nearest station. TAPR therefore asks the Commission to strike the proposed automatic power control language of this section. TAPR feels that the provisions of section 97.313(a), which limits the power level to the minimum required to maintain communications is all that is necessary to cover the concerns which prompted this proposed rule change.

Further, TAPR would like to see the limit on transmit power to 100 watts of this section also deleted. While TAPR does feel that 100 watts of power is more than enough for most terrestrial SS operations, this limit may present problems for some of the more interesting applications in the service today such as EME

(Earth-Moon-Earth) operations. It would appear that the 100 watt limit was imposed back in 1985 out of a concern for limiting the range of possible SS interference, this concern appears groundless in the operating environment that we now face today. TAPR therefore asks the Commission to strike this provision and allow SS emissions the same transmitter power levels allowed for the other emission modes authorized for the service.

Second, TAPR does not agree with the Commission's decision to allow sections 97.311(e) and (f) to stand as written. Both sections place a significant record-keeping burden on any operator who wishes to make use of the SS emission mode.

While these sections may have made sense back in 1985, twelve years later all they serve to do is to present a serious impediment to any amateur operator who wishes to experiment and deploy this mode. TAPR therefore asks the Commission to now establish parity between SS and all of the other emission modes (including pulse) and delete the burdensome provisions and requirements of these sections.

In addition to the rule changes proposed in the NPRM, TAPR would also like the Commission to consider making additional changes in the rules effecting SS emissions.

First, TAPR would ask that the Commission allow SS emissions on all amateur radio bands above 50 MHz. As we have stated earlier, TAPR feels that the Commission's rules for SS should go no further than to set a maximum transmitter output power level and to set reasonable limits on spurious emissions outside the amateur radio bands. Conventions for all other parameters of operation such as operating frequencies, modulation method, bandwidths, protocols, etc. are best left to the development of the amateur radio community itself. Such an approach would be in line with the stated policy of the Commission itself in the NPRM to develop rule changes which are "...consistent with our policy of encouraging greater spectrum flexibility by enabling licensees to introduce innovative technologies and to respond quickly to demands for new and different services and applications, without administrative delays." TAPR feels that SS technology will provide for such innovation in the service and has great applicability to amateur bands below 70 cm (SS now only being allowed on bands 70 cm and above).

Second, TAPR feels that the station identification requirements of section 97.119(b)(5) should be deleted. The interference and harm to the band in which an SS station is operating that would be caused by a requirement to use a CW identification far outweighs the benefits that would accrue for monitoring purposes from the use of such an ID. Further, it is vital to avoid an ID requirement that would in itself cause interference even when the associated SS emission does not. TAPR feels that it would be better for the amateur radio community to develop approaches for handling the necessary functions of monitoring and identification of SS emissions.

Conclusion

SS technology can provide many useful benefits to the amateur radio community if its use becomes more widespread and mainstream. In order to accomplish this however, certain changes must be made to the Commission's rules governing the use of SS in the amateur radio service. By making these changes, the Commission will create a regulatory environment that will give members of the amateur radio service enough flexibility to develop innovative equipment and hardware employing SS technology.

For these reasons, TAPR urges the Commission to promptly issue a report and order in this rulemaking as soon as possible to facilitate the development and deployment of SS communications in the amateur radio service, as proposed in the NPRM and as modified herein.

Reply Comments Of Tucson Amateur Packet Radio Corporation

The Tucson Amateur Packet Radio Corporation ("TAPR") submits these reply comments in response to the above-referenced notice of proposed rule making (the "NPRM") released by the Commission on March 3, 1997.

As demonstrated in TAPR's initial comments, the rule changes proposed in the NPRM represent, for the most part, the logical next step in the regulation of Spread Spectrum ("SS") communications technologies in the Amateur Radio Service. By providing amateur radio operators greater design and operational flexibility, the Commission will help to promote the development and deployment of the next generation of SS technologies.

Nonetheless, in a few areas, the Commission's proposals go too far (1); and in other areas, not far enough (2). In addition, several parties have opposed various aspects of the Commission's proposed rule changes on narrow and short-sighted grounds (3). Thus, and for the reasons set forth more fully below, TAPR urges the Commission to adopt the rule changes proposed in the NPRM with the clarifications and modifications set forth in TAPR's initial comments.

Discussion

1. The Parties To This Proceeding Support the Commission's Proposed Less Restrictive SS Rules.

In general, all parties support the Commission's decision to delete sections 97.311(e) and (d), in order to permit SS emissions and spreading codes that are not currently authorized. Elimination of the rule that dictates

specific spreading codes is necessary to facilitate further experimentation and deployment of SS technology to the amateur radio service. In particular the removal of the provision that restricted the use of hybrid SS emissions will open up potentially new areas of interesting experimentation that have not been allowed for over fifteen years now.

II. The Parties To This Proceeding Support the Relaxation of the SS Record Keeping Requirements

There appears to be a consensus of commenters which does not agree with the Commission's decision to allow sections 97.311(e) and (f) to stand as written. Both sections place a significant record-keeping burden on any operator who wishes to make use of the SS emission mode. While these sections may have made sense back in 1985, twelve years later all they serve to do is to present a serious impediment to any amateur operator who wishes to experiment and deploy this mode. TAPR therefore asks the Commission to follow the directions of the commenters and now establish parity between SS and all of the other emission modes (including pulse) and delete the burdensome provisions and requirements of these sections.

III. Some Parties To This Proceeding Support the Deletion of the 100 W Power Limit for SS

Several commenters have agreed with TAPR's position that the limit on transmit power to 100 watts of section 97.311 should also be deleted. While TAPR does feel that 100 watts of power is more than enough for most terrestrial SS operations, this limit may present problems for some of the more interesting applications in the service today such as EME (Earth-Moon-Earth) operations. It would appear that the 100 watt limit was imposed back in 1985 out of a concern for limiting the range of possible SS interference. this concern appears groundless in the operating environment that we now face today. TAPR therefore asks the Commission to strike this provision and allow SS emissions that same transmitter power levels allowed for the other emission modes authorized for the service.

IV. The Parties To This Proceeding Support the Deletion of the Automatic Power Control Proposal

There appears to be general disagreement by the commenters with the proposed automatic power control ("APC") provision of section 97.311(g). Although TAPR supported the ARRL proposal for this provision in the comments and reply comments that it filed in RM-8737, it no longer feels that this provision should become a part of the rules governing SS emissions. Further discussion and experimentation that has taken place since the petition phase of this proceeding has convinced TAPR that the implementation of this provision would impose a serious handicap on the future development of this emission mode. As was pointed out by the comments of Phil Karn, KA9Q, the idea of including the concept of APC in the League's Petition of December, 1995, originated with him as a member of the ARRL's Future Systems Committee. KA9Q has now gone on record in these proceedings as agreeing that APC is not workable under all circumstances and should be dropped as a requirement for Amateur SS communications. While TAPR agrees that technically it is simple to control the output power of a transmitter, it is quite another matter to make this control automatic and foolproof over the wide range of applications and uses that are common today in the service. For instance, the implementation of this provision would make it impossible to use SS emissions in the point-to-multipoint packet radio networks that are common in the service today because it would be difficult to transmit a single packet which would not exceed the Eb/No level at the nearest station. TAPR therefore asks the Commission to strike the proposed automatic power control language of this section. Several commenters, including TAPR feel that the provisions of section 97.313(a), which limits the power level to the minimum required to maintain communications is all that is necessary to cover the concerns which prompted this proposed rule change.

V. Some Parties To This Proceeding Support the Use of SS In Amateur Radio Bands Above 50 MHz

Several commenters have indicated support for TAPR's position that the Commission allow SS emissions on all amateur radio bands above 50 MHz. As we have stated earlier, TAPR feels that the Commission's rules for SS should go no further than to set a maximum transmitter output power level and to set reasonable limits on spurious emissions outside the amateur radio bands. Conventions for all other parameters of operation such as operating frequencies, modulation method, bandwidths, protocols, etc. are best left to the development of the amateur radio community itself. Such an approach would be in line with the stated policy of the Commission itself in the NPRM to develop rule changes which are "...consistent with our policy of encouraging greater spectrum flexibility by enabling licensees to introduce innovative technologies and to respond quickly to demands for new and different services and applications without administrative delays." TAPR feels that SS technology will provide for such innovation in the service and has great applicability to amateur bands below 70 cm (SS now only being allowed on bands 70 cm and above).

VI. The Parties To This Proceeding Support the Removal of the Narrowband ID Requirement for SS

There was general support among the commenters which supported TAPR's position that the station identification requirements of section 97.119(b)(5) should be deleted. The interference and harm to the band in which an SS station is operating that would be caused by a requirement to use a CW identification far outweighs

the benefits that would accrue for monitoring purposes from the use of such an ID. Further, it is vital to avoid an ID requirement that would in itself cause interference even when the associated SS emission does not. TAPR feels that it would be better for the amateur radio community to develop approaches for handling the necessary functions of monitoring and identification of SS emissions.

Conclusion

With the modifications and clarifications described above and in TAPR's initial comments, TAPR generally supports the rule changes proposed by the Commission in the NPRM.

Notes:

1. For instance, the Commission's concerns about the need for automatic power control are unfounded. See, e.g., Comments of Phil Karn ("KA9Q"); Comments of Lyle Johnson ("WA7GXD"). Consequently, any suggestion that extreme measures such as mandatory automatic power control should be rejected.
2. As discussed more fully below, the Commission should allow the use of SS emissions in all amateur radio bands from 50 MHz.
3. See, e.g., Comments of Metricom (continuing its assault on Part 97 SS use of the 15M bands); Comments of Part 15 Coalition (same).

Don't Forget the 1997 ARRL and TAPR Digital Communications Conference

October 10-12, 1997
Baltimore, Maryland (minutes from BWI airport)
Web: http://www.tapr.org/dcc

The 1997 ARRL and TAPR Digital Communications Conference will be held October 10-12, 1997 in Baltimore, Maryland. This year's conference location is just minutes away from the BWI (Baltimore/Washington International) Airport.

Symposiums and Seminars

In addition to the presentation of papers on Saturday, three symposiums/seminars will be held before and after the conference.

- APRS
- RF Basics for Computer Weenies
- Spread Spectrum System Design and Theory

These sessions are provided to allow those with additional time and interest to make the most of the Digital Communications Conference. For those that might have interest in just a symposium or seminar, registration for the conference is not necessary to register and attend one or more of the symposiums and seminars. This allows maximum flexibility for those that might want to participate during the Digital Communications Conference, but do not have an entire weekend to devote to the event.

APRS Symposium

A full day symposium on Friday covering APRS will be conducted by Bob Bruninga, WB4APR (father of APRS) , Keith Sproul, WU2Z, Mark Sproul, KB2ICI (developers of Mac and Windows APRS), Steve Dimse, K4HG (developer of javAPRS), and other nationally known APRS leaders. Join this group for the afternoon and evening for in depth discussions and presentations on the current and future status of APRS. This is a unique opportunity to gain insight into this fast growing digital aspect of amateur operations that combines computers, packet radio, and GPS (Global Positioning System).

RF Basics Seminar

Starting late Friday afternoon a half-day seminar entitled "RF Basics for Computer Weenies: Helping the RF-challenged get the most out of the new high-speed wireless toys." The seminar will focus on such topic as basic antenna types and their characteristics, comparison of feedlines and connector types, propagation basics (calculation of path loss, multipath effects, fresnel zones, etc), weatherproofing, lightning protection, filters, basic RF measurements, and other issues related to maintaining radio equipment on the 1200/9600 bands. This seminar will be starting late enough in the afternoon on Friday to allow those flying in on that day to attend the seminar. Mike Chepponis, K3MC, will conduct this seminar.

Spread Spectrum Seminar

On Sunday morning, Dewayne Hendricks, WA8DZP, Phil Karn, KA9Q, and Tom McDermott, N5EG, will conduct a seminar focusing on "Spread Spectrum system design and theory." All three presenters are well known for their work in various areas of amateur digital communications and this 5 hour seminar should be an excellent opportunity to learn about the design and theory of spread spectrum systems. This seminar is a follow up to the past two seminars of PCS technology by Dewayne Hendricks with a new focus on system design.

Saturday Evening Banquet

Keynote speaker for Saturday's dinner will be Yutaka Sakurai, Sr. Manager of Science Office, Nihon Cisco Systems K.K. (Cisco Japan), and is a major representative within PRUG (Packet Radio Users Group) in Japan. Sakurai-san should give a good presentation and we will all find it interesting to hear what the packeteers in Japan are developing and how they operate.

What can you expect during the 1997 ARRL and TAPR Digital Communications Conference?

- A full day of papers, breakout sessions, and selected topics on Saturday for the beginner to the advanced amateur digital enthusiast.
- Three seminars/symposiums:
  - Friday (1pm) - APRS; Conducted by:
    Rob Flaninga, WB4APR
    Keith Sproul, WU2Z
    Mark Sproul, KB2ICI
    Steve Dimse, K4HG
  - Friday (3pm) - RF Basics for Computer Weenies
    Conducted by Mike Chepouis, K3MC
  - Sunday (8:30am) - Spread Spectrum System Design and Theory; Conducted by:
    Dewayne Hendricks, WA8DZP
    Phil Karn, KA9Q
    Tom McDermott, N5FG
- The second annual Student paper awards.
- TAPR Membership Meeting
- A banquet with Special Guest Speaker Yutaka Sakurai
- SIGs (Special Interest Groups) on Saturday following the banquet.
- Informal get-togethers throughout the weekend.
- A meeting facility that is perfect for this type of meeting.
- Informal engineering discussions/demo areas.
- An event at which the most important new developments in amateur digital communications are announced.
- Digital 'movers and shakers' from all over the world in attendance.

Hotel Information

Conference presentations, meetings, and seminars will be held at the Holiday Inn BWI Airport. DCC special rooms rate is $89 per night. When making reservations with the hotel, be sure to indicate you are attending the ARRL and TAPR DCC to get the discount. It is highly recommended that you book your room prior to arriving - a block of 75 rooms is reserved until **September 9th, 1997**. After the 75 rooms are booked, rooms will only be available in nearby hotels. Be sure to book your rooms early! The hotel provides transportation to and from BWI Airport, nearby Amtrak/MARC rail station, and the local Baltimore Light Rail. Please contact the hotel to arrange specific transportation needs.

Holiday Inn BWI Airport (conference hotel)
890 Elkridge Landing Rd, Linthicum, MD, 21090
(410) 859-8400, Fax (410) 684-6778

GPS-30PC Offer

Special One Time offer on the Garmin GPS30PC for $99

Garmin has made available to TAPR members for a short time only the Garmin GPS30PC, which Garmin has discontinued and is wanting to clear from their inventory.

TAPR will take orders until August 30th, when we will place one order for as many units as the TAPR membership wishes to purchase. There is no limit to the number any one person or affiliated group wants to purchase. There is a total of 700 units being made available to TAPR.

The GPS30PC is a GPS-20 packaged with a passive antenna in a weatherproof housing with a 10 foot cable terminated in a DB9 connector (for serial port 1) and a cigarette lighter connector (for power). Since it only uses one serial port, it is not DGPS capable. The insides implement all features of the GPS-20, but the cabling only reveals serial port 1 and the power supply. You can cut the case open to get to the other signals if desired. The GPS-20 also is wired directly to the antenna, so if you remove the antenna from the GPS-20, an MCX connector will have to be connected to the GPS-20 to provide an antenna connection. Surface MCX connectors that will work are available from DigiKey and Mouser.

GPS30PC from Top

The price to TAPR members is $94 plus $5 shipping/handling for a total price of $99. A normal GPS-20 unit alone sells to TAPR members for $169! To this you would need to add a $40 or more antenna to have the same functionality of the GPS30PC for a real experimenters price.

TAPR will take orders for this special one-time item until August 30th. At that time we have to

out a check to Garmin and get the units shipped.

Since this is a liquidation, there are several conditions to the special offer.

Please be sure you read all the following very carefully.

- Garmin has stated that most of these units are in good working condition, but some of them may occasionally fail to acquire satellites at ambient temperatures near 40 degrees F. Usually, this problem can be fixed by resoldering the shields near the board edge connector more carefully. For the typical consumer who deals with Garmin, this is a return issue; however, for amateur radio experimenters correcting this problem should not be too serious to handle.
- The downside to working on the 'sealed antenna unit with GPS-20' is that to resolder the shields, you have to remove the case by sawing or cutting the bottom off. That means that in order to rework the board, you have to damage/harm the case.
- The upside is that for $99 you get a GPS-20 engine and antenna. Even if you have to perform surgery to get one or the other to operate correctly, you have still saved money for your time and effort. The GPS-20 is worth the $99.
- This is an 'as is' deal since this is a liquidation by Garmin on a unit that they have discontinued and are trying to remove from inventory. The normal sales price was $100. If you decide to return your unit, because it is inoperative, TAPR will not be able to return the unit to Garmin. Again, these are AS IS units, which is the reason for the great price. They should, for the most part, all work, but things do happen. To take care of members that have units that are Dead on Arrival (DOA), TAPR will accept returned non-functional units within the first 60 days after TAPR ships. See the refund policy below.

$99 Garmin GPS-30PC !!
Includes documentation for a GPS-20 and for the interface to the GPS-40P.
Order by August 30th, 1997
http://www.tapr.org/gps

If anyone is interested in troubleshooting the returned units, we will be glad to make a deal — contact Greg Jones, wd5ivd@tapr.org.

Warranty and Refund Policy

TAPR will accept returned non-functional units promptly reported by the purchaser within 60 days after TAPR ships. These units are provided on an "as-is" basis and **no refunds will be given**; however, members returning non-functional units (within 60 days) will receive an extension to their TAPR membership of three years.

Questions concerning the unit and details on the buy will be handled on the TAPR GPS Special Interest Group list. (To be created soon).

Shipping and Handling

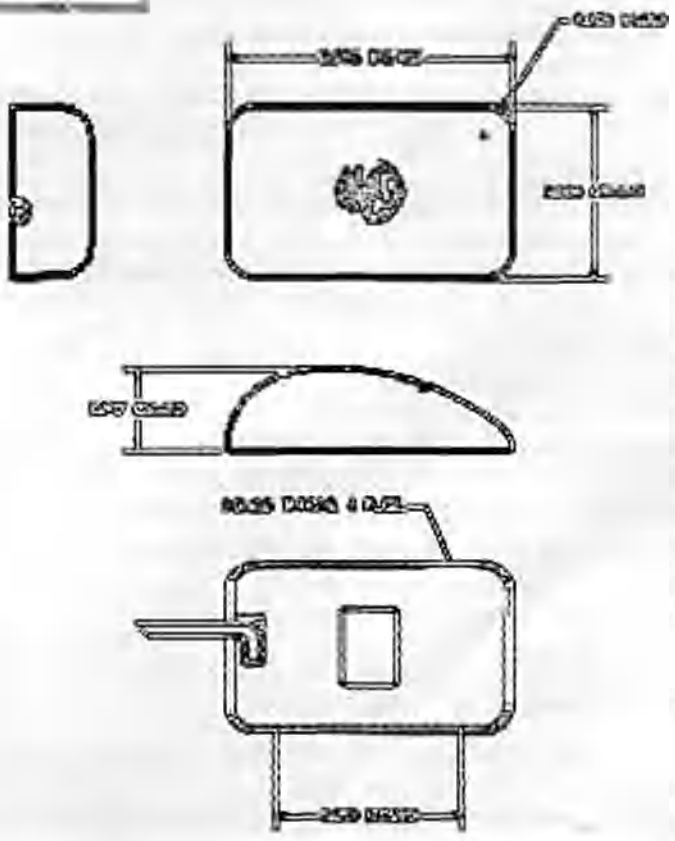
- Shipping and Handling within the US will be $5.00 US by UPS Ground unless otherwise requested by purchaser.
- International Shipping will need to contact the TAPR office and get a quote on the shipping to your country. TAPR uses International Express Mail, unless the purchaser requires something else.

Notice about all TAPR Group Purchases

TAPR coordinates group purchases as a service to help amateur radio operators obtain access to technology at prices better than those typically available in individual unit orders.

Those participating in group purchases must understand that these products are not part of TAPR's standard offering, that TAPR may not have an established relationship with the vendors involved, and that the terms of the purchase may be changed, or the purchase may be cancelled, for any reason. If purchase terms (such as price or delivery schedule) significantly change during the order period, TAPR will notify you and permit you a reasonable time in which to cancel your order; if you choose to cancel, TAPR will refund any money you have deposited for the purchase. Once TAPR has committed the group order with the vendor, no further cancellations are permitted. IN NO EVENT WILL TAPR'S LIABILITY TO YOU EXCEED A REFUND OF ANY MONEY YOU DEPOSITED FOR THE PURCHASE.

Although informal support for products may be available through TAPR's on-line mailing lists and other services, product warranties and entitlement to post-sale support are limited to what is offered by the manufacturer, and are not TAPR's responsibility.



Drafting Views of GPS30PC

TAPR TAC-2 (Totally Accurate Clock)

http://www.tapr.org/tapr/html/tac2.html

It is with considerable pleasure that TAPR can announce that version 2 of "Totally Accurate Clock" (TAC-2) is now available in kit form. TAPR has been working with Tom Clark, W3IWI, to make an improved version of the TAC available to all. TAC-2 Rev.C of the kit is now available from TAPR.

The "Totally Accurate Clock" TAC-2 kit is intended to serve several purposes:

- It provides a "universal" electrical and mechanical interface for a number of common OEM board-level GPS receivers including specifically:
  - Garmin GPS-20
  - Motorola Oncore
  - Trimble SK8
- It provides interfaces for the 1 pulse-per-second (1PPS) signal generated by these receivers:
  - Low-impedance, fast rise-time 1PPS signals for "laboratory" applications.
  - RS232 level 1PPS signals for computer applications.
  - Specialized 1PPS interfaces for an add-on PCB that will stabilize a low-cost crystal oscillator to an accuracy ~ 1 part-per-billion
- It provides several different power supply options to make use of your GPS receiver easier. The power interface is similar to (and compatible with) those used for computer disk drives:
  - A low-cost, (7805-type) regulator.
  - A high-efficiency switching power supply.
  - Direct 5 volt power.
- It has provision for an Uninterruptable Power Supply (UPS) to buffer the GPS receiver through brief power outages.
- It provides Battery Backup so the GPS receiver can wake up "smart."
- It can provide isolated power for an amplified GPS antenna.

Since the TAC-2 has so much flexibility, there are several options you will have to choose from during construction. The "base" implementation will satisfy the needs of many radio amateurs with support for the Garmin GPS-20 and Motorola ONCORE Basic receivers. A few jumper changes enable support for the Motorola ONCORE VP/UT receiver. Some added parts and some more jumper changes are needed if you plan to use a Trimble SK-8.

The TAC-2 is offered as a kit which will take approximately 2 or 3 hours to build.

The TAC-2 kit has been designed to be very easy to assemble. TAPR supplies detailed instructions that only require you to know which end of the soldering iron is hot and a little knowledge on how to put things together!

One of the major interests that TAPR has in GPS timing is in the use of GPS as a way to steer ("discipline") an oscillator. By tying together a low-cost crystal oscillator and a GPS receiver, it is possible to have a Rubidium-class (better than one part per billion) frequency standard. The TAC-2 has been designed to support this function and the TAC-2 project team is working on developing the "TOC" (TAC Oscillator Controller). The plan is that the TOC will plug directly into the TAC-2 circuit board. More information on this project will be made available as progress is made. No time is set for delivery of this daughterboard at this time.

Steve Bible, N7HPR and Tom Clark, W3IWI with their plaques for completion of the TAC-2 project.

General Information

The price is:

$125.00 US for members of TAPR, or
$139.00 US for non-members
plus shipping and handling ($5 in the U.S.)

And will include:

- TAC-2 Rev C PCB Board
- All necessary parts for the TAC-2 to allow interface to either the Oncore VP or Garmin GPS-20
- Documentation

Please note: This is not an enclosed unit. Enclosures are being worked on, but will not be available until the fall.

Questions concerning the unit and details on the buy will be handled on the TAPR GPS Special Interest Group list.

Differences between the version 1 and version 2 designs

- The circuitry has been improved in a number of areas:
  - better low-Z 1PPS buffers.
  - better RS232 drivers.

- full "Plug 'n Play" support for any of the Motorola ONCORE receivers (the original PVT-6/BASIC, the 8-channel VP or the new UT-series) and several other receivers as well.
- A number of power supply options have been provided, including
  - the TAC-2 can look like a "disk drive" when mounted in a PC
  - an optional high-efficiency switching power supply
  - an UPS (uninterruptable power supply) capability (good for a few minutes)
  - an optional regulator for external antenna bias
  - several BBRAM "keep alive" power options, etc.
- The off-board connections for the original TAC were all soldered wires. On the TAC-2, we made extensive use of IDC ("crimp-on") connectors for ease of assembly and reliability.
- The ONLY significant deletions from the original TAC are:
  - the on-board MMIC L-band IF amplifier.
  - The original GSFC-supplied TACs were in a metal box (we used off-the-shelf RS232 "A/B" switch boxes). The TAPR TAC-2 is a bit-form circuit board. You have to provide your own mechanical mounting (for the time being).
  - An A/B switch box would work fine as a mounting. Another possibility is that the TAC-2 circuit boards are about the size of a small computer disk drive and the power connection is the same as on a disk drive. TAPR is planning a mounting that would put the TAC-2 in a disk drive bay inside your PC.

Totally Accurate Clock (TAC)

Excerpts from "Totally Accurate Clock Announcement," Tom Clark, NASA/GSFC (February 2, 1995)

The "TAC" name is supposed to invoke a smile on your face. Many of you remember Heathkit's "Most Accurate Clock" (a WWV receiver) and I see advertisements for VLF clocks (WWVB in USA, DCF77 in Europe) that still use the "Most Accurate Clock" name in their advertising. Since the "TAC" is 3-4 orders of magnitude better than the "Most Accurate Clock" units, the "Totally" name seems warranted (also, TAC are my initials and this was begun as a home project!).

The TAC project began when I was on sabbatical at Omaha when Bernt Ronnang got me an early prototype of a Motorola PVT-6 OEM GPS receiver. In that incarnation, the PVT-6 was pretty disappointing. When I got back home, I had Motorola update the internal firmware and found that its personality had changed completely — it was now very precise, but it had about a 500 nsec bias. I contacted a friend at Motorola who was involved in the PVT-6 software and he told me that tests at USNO had uncovered the same error. I was added to the "beta" group, got my initial prototype updated with the latest firmware and began more detailed testing. What I then found was that the PVT-6 receiver had the best timing performance I have seen in any small GPS receiver. With a small amount of care in setting it up, it now gives 50 nsec or better RMS timing precision and biases appear to be ~20 nsec.

The TAC project now involves both hardware and software. Let me briefly describe both to you.

Hardware

The core of the TAC consists of a GPS. Several are going to be supported in the TAC-2 design (Motorola ONCORE, Garmin GPS-20, Trimble SV-6). The circuit board allows these various GPS to be mounted to the board.

The TAC-2 adds a number of desirable features:

- The 1 PPS output signals are buffered through a 74AC04 gate to improve the drive capabilities and to act as a "fuse" to prevent damage to the receiver in case of an operator goof. Up to three independent buffered outputs are provided, and the buffers will drive about +2 to +2.5 volts into a 50 ohm termination. The normal logic polarity is positive going at the epoch time, but this can be inverted if desired by some simple jumpers.
- Up to three open collector 1PPS signals are also available, negative going. Normally these would be used to drive display LEDs, but they can be used for other purposes.
- The add-on board includes an RS232 driver that provides 1 PPS time synchronization to an attached computer. The 1 PPS signal is normally connected to the computer's DCD input.
- The RS232 I/O to the computer is buffered and isolated from the receiver to act as a "fuse" to prevent damage to the expensive receiver in case of an operator goof. An RS232 OR-gate is supplied for the receiver input signal to allow RTCM SC104 Differential GPS signals to be fed to the GPS receiver.

Software

A program called SHOWTIME displays the current time in BIG DIGITS you can see from across the room. In addition to just showing the UTC time, it includes a display of the date, day-of-week, day-of-year, local and Greenwich Mean Sidereal times, JD and MJD, and even the current GPS week. You can enable audible "WWV-like" time ticks to assist you in setting the formatter (or your wrist-watch). You can have the software automatically reset the PC's internal clock with about 25 msec accuracy. All the time display updates and audible ticks happen synchronously with the GPS 1 PPS signal because the PC reads the tick on its DCD line.

SHOWTIME allows you to enter timing offsets and handles all the arithmetic for you. It allows you to make easy corrections for time delays in cables and the instrument and it tells you (with 1 nsec resolution) the actual epoch of the 1PPS tick and it gives you an estimate of the accuracy of the fix. SHOWTIME gives you a nice display of which satellites you're using and which satellites are above the horizon. This includes a bar-graph "S-meter" for each of the GPS satellites currently in lock which are updated once per second.

The software lets you change operating modes (timing vs. position, elevation masks, satellite selection criteria, etc) easily and when you are running in position-determination mode, it will handle all the position averaging tasks for you. At any time, you can save the current configuration (positions, timing offsets, receiver modes, etc) to a disk file and restore that configuration at a later time.

At this time SHOWTIME runs stand-alone on a separate MS-DOS PC (but it does seem to run OK in the DesqView multitasker). Once you have set parameters into the GPS receiver, the PC operations can be terminated.

New APRS-SIG Moderator/Chairperson

I'm pleased to announce that Stan Horzepa, WA1LOU, is the new APRS SIG moderator and chairperson. Stan is very active in APRS-SIG and he's been a great supporter of the activity. Keith Sproul, WU2Z, who was responsible for the formation of the APRS-SIG will be able to spend more time supporting the APRS community through further software and technical developments.

Please join me in welcoming Stan to his new role. — Greg Jones, WD5IVD, President, TAPR

Hello APRS-SIG folk,
Effective today, the honorable Keith Sproul has retired as the chairperson of the APRS-SIG. I have taken his place.

In light of this change, I feel that a few rules need to be mentioned in order to assure the continued smooth operation of the APRS-SIG. Here they are, short and sweet:

1) Stick to the subject (APRS). That means no virus alerts, no chocolate chip cookie recipes, no surplus gear fire sales, no nothing that isn't directly related to APRS.

2) No abusive behavior demonstrated towards a list member will be tolerated on the APRS-SIG. Please take your flames elsewhere.

3) I reserve the right to unsubscribe any list member who violates these rules without warning. That means one strike and you're out of here.

Finally, if you wish to unsubscribe from APRS-SIG, send a message to listserv@tapr.org containing only the following line in the body of the message:

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signoff APRSSIG
```

Have fun!
Stan Horzepa, WA1LOU
wa1lou@tapr.org

Kits/Publications Update

Motorola Oncore VP Interface Board

TAPR now offers a power supply/interface kit for both GPS units we offer. For the Motorola Oncore VP, we are pleased to bring to the membership the Interface Board Kit by McKinney Technology. Doug McKinney, KC3RL, has produced this board for some commercial customers and is now making it available to TAPR for its members.

[left] Oncore VP power supply and mounting kit next to a Oncore VP.
[right] Oncore VP mounted on power supply and mounting kit.

This kit provides:

- A GPS Interface Board Kit for the Motorola Oncore VP
- All parts included - including screws and stand-offs
- Same size as Motorola Oncore VP 2" x 3.25" x 0.95" (with stand-offs)
- RS-232 interface for input and output control
- DGPS input (select RS-232 interface between computer or DGPS control)
- High-efficiency LM2574 step-down regulator provides 5 VDC from 7-30 VDC input

The price is:

$31.50 US for members of TAPR
or
$35.00 US for non-members + shipping/handling

TAPR currently has about 30 of these kits in stock. See http://www.tapr.org/tapr/html/vpib.html for more details.

APRS MIC-E Project Update

150 units arrived at Dayton and went on sale Friday!!! Lots of interest and lots of sales. We shipped maybe 50 back to the TAPR office. If you want your TAPR APRS Mic-Encoder, there are units available at the office. See http://www.tapr.org/tapr/html/mic-e.html for full details on the kit and photos of the unit. Bob Bruninga, WB4APR, Gwyn Reedy, W1BEL, Ron Parsons, W5RKN, Steve Dimse, K4HG, and Will Clements, received plaques during the TAPR banquet for their effort in getting the TAPR APRS MIC-E project completed. Thanks a bunch, guys!

TAPR, working with PacComm has begun to license the design of the TAPR APRS Mic-Encoder to one of the more prolific amateur radio manufacturers. As soon as a product is available from that vendor, we will let you know about it. Always a good sign of good work when one of the industry is interested in licensing the project.

Front panel of MIC-E.

A support list has been created to answer build questions and comments. mic-e@tapr.org can be subscribed to by sending e-mail to listserv@tapr.org and in the body of the message enter (on one line):

```
subscribe mic-e First_Name
Last_Name Callsign
```

TUC-52 and METCON-II personality board

The TUC-52 board has gone to the board house for beta testing. Paul Newland, AD7I, has submitted the design of the METCON-II personality board for layout and alpha board run. The project is progressing, although a little slow at times. There have been several commercial inquiries about licensing the new METCON-II design and we hope to be able to take advantage of these once we have boards available. We had planned on making a beta-testers' application available on the web, but haven't done that yet. If you are interested in beta-testing the METCON-II unit, then you need to send e-mail to wd5ivd@tapr.org and Greg will collect all the names interested.

AN-93

TAPR promised in the last *PSR* that the AN-93 would be shipping. Promise broken. Greg Jones, WD5IVD, was working on getting the documentation completed and had to drop that project to work on other more urgent matters. We expect to see movement to complete the docs and get the kits test built by the end of the summer. We need to find at least three people who want to volunteer to build the first three kits using the docs in order to check the clarity of the documentation and build. If you are interested, e-mail wd5ivd@tapr.org.

TNC-95

The TAPR Board, on recommendation from the TNC-95 project manager, has terminated the TNC-95 project. As with many TAPR projects, some are successfully completed and others are things to be placed into the history book.

For those members not familiar with the original goals of the project, let's outline them now. The purpose of this project was to make available a replacement for the TNC-2 bare boards TAPR had been offering since 1991 and stopped in 1994. Also, the TAPR/AMSAT DSP-93 required an internal controller. The TNC-95, was never meant to be a next step in TNC technology, as some have criticized the project, but as a simple TNC kit that people could build once again from available components. Once PacComm had done a version of their TNC for the TAPR/AMSAT DSP-93, that need was met. With the problems in getting code made available for the unit, the TAPR board felt that it was just better to close the project after three years than to continue to work on it. Resources are better spent now on current projects.

Design and Alpha testing only cost TAPR $450 over the two years of the project. Beta boards were never submitted to the board house, due to the lack of movement on the firmware side of the project. That design and development money hasn't been wasted though, since we have signed an agreement with another group to trade technology. They want access to the TNC-95 design to support some of their projects and TAPR is using some of their technology in the TAPR 9600 baud modem redesign project. Both groups come out ahead..

Rear panel of MIC-E.

TAPR would like to thank John Koster, W9DDD, Bob Morgan, WB5AOH, and Howie Goldstein, N2WX for their work on the project up to this point.

TAC-2

TAC-2 kits are completed and ready for shipping! We had hoped to have the kits available at Dayton and would have if we hadn't had a design issue crop up just as the board was to be put into the board house. It took until Dayton weekend to get the issues raised on the design corrected and then the board run was submitted about a week after Dayton.

TAPR Publications

Wireless Digital Communications: Theory and Design, by Tom McDermott, N5EG, has been going quickly. If you haven't gotten your copy yet — better get an order in!! We printed 1000 copies of the book and it looks like we will be doing a second printing before the end of the year.

Tom McDermott, N5EG, showing the TAPR plaque thanking him for his effort in writing the *Wireless Digital Communications: Theory and Design* book.

TCP/IP Book

John Ackermann's TCP/IP book has another chapter completed and we are working on adding the required graphics to the book. Steve Stroh, N8GNJ, has taken over editing the book. We hope that this will speed up the process of getting the book ready to get layed out and printed.

1997 CD-ROM

The TAPR CD-ROM in its second year is very popular. The CD-ROM has really helped the office staff, by drastically reducing requests for duplication of 3.5" disks with software on it. The software library, when on disks, was very time consuming to do for Heather and now Dorothy at the office. We are glad to see people getting the CD-ROM now as a replacement to duplicating all those disks. The HTML interface has been very popular on this issue and it looks like we will keep that for next year as well. Using a web browser locally on your computer, you can access the information and navigate around. We should be adding the NADSD javAPRS functionality to next year's CD-ROM as well, now that Steve Dimse has a solution for doing that. The CD is an ISO-9660 standard, which will allow it be accessed on any number of platforms. The price will not change from last year — $20, + $4 s/h. Keep an eye on TAPR-BB and the web page for information before the next *PSR*.

TAPR 9600 baud Land Mobile Modifications Publication

The decision was made at the last TAPR board meeting to make the information collected on these modifications available on the web site instead of doing a publication. These should all be available on the TAPR web page by August. The authors of the various segments are reviewing and making additional corrections before we make the modifications available to all. Providing this information on the web rather than in print will allow TAPR to add additional modifications and hints as they become available.

You too can wear a TAPR shirt!

We've had members over the years ask about TAPR shirts and after discussion and locating a place that does embroidered shirts at a good price, TAPR can now offer shirts to the members. All the board members attending Dayton wore a shirt one day or the other, so if you were at Dayton you saw them first hand.

TAPR is making available four types of shirts in all sorts of colors and sizes. Each shirt has the TAPR logo (choice of three styles) embroidered on the left chest. Members may add their name and call for a slight additional cost. We haven't developed a way to show the shirts on a flyer yet, but you can see the different shirts and specify the exact color, size, and other combinations and choices via http://www.tapr.org/tapr.html/shirts.html or from the link on the TAPR home page. Just view the web page, determine which shirt you like, select the correct size and color, and place your order. Orders for shirts are placed at the first of each month and may take 1-2 weeks before they can be shipped from the office.

The shirts being offered include:

100% Cotton T-Shirt: $19.00

100% heavyweight preshrunk cotton t-shirt
Sizes: S, M, L, XL, 2X, 3X
Colors: Natural, White, Ash, Azalea, Dandelion, Heather Grey, Iris, Violet, Black, Charcoal, Eggplant, Lake, Leaf, Navy.

Collared Shirt: $29.00

Collared Shirt, 50% polyester/50% cotton
Fashion knit collar and rib cuffs
Two button clean finish top-stiched sally placket with reinforced box
Sizes: S, M, XL, XXL, XXXL
Colors: Ash, Black, Burgundy, Cream, Forest, Gold, Hunter, Jade, Kelly, Maize, Navy, Orange, Peach, Pink, Plum, Powder Blue, Raspberry, Red, Royal, Silver, Tan, Turquoise, White, Sports Grey.

Cotton Pique Shirt: $44.00

100% Ringspun combed cotton heavyweight pique
Contrasting collar, cuff, and placket, welt cuffs, extended tail with side vents
Two button clean-finished placket, woodtone buttons
Sizes: M, L, XL, XXL
Colors: (shirt/cuffs & collar/placket)
1 - White/Dark Navy/Cranberry
2 - Red/Navy/White
3 - Jade/Navy/Fuchsia
4 - Purple/Jade/Fuchsia
5 - Sand/Black/Nut
6 - Cranberry/Navy/Hunter
7 - Hunter/Green/Maroon
8 - Navy/Jade/Fuchsia

Pique Golf Shirt: $59.00

100% combed cotton double mesh pique golf shirt with vertical stripes
Taped fashion collar with welt cuffs
Two wood-tone button placket
Side vents and dropped tail
Sizes: M, L, XL, 2X
Colors: (right/center/left)
59 - Dark Olive/Laden/White
15 - Navy/Forest/White
47 - Ruby/Navy/White
99 - White/Red/Navy
87 - Taupe/Natural/Black
58 - Forest/Black/White

You have a choice of three TAPR logo styles which is embroidered on the left chest. The logo is about 1.5" wide by 2" high.

Logo Style 1

Black Background
Black Lettering
White Center Element
Black Border around Logo

Logo Style 2

Red Background
Red Lettering
Silver Center Element
Black Border around Logo

Logo Style 3

Blue Background
Blue Lettering
White Center Element
Black Border around Logo

Summary of Electronic Meeting of the TAPR Board of Directors September 23, 1996 through May 13, 1997

(Edited for publication)

Several separate discussions of a proposal to create a Regional Digital Group Affiliation Program. The final version of the Proposal will be presented at the May 15, 1997 BoD meeting in Dayton, Ohio.

There was an ongoing discussion on finding a replacement for Alan Paine KB5OOK for the position of Software Librarian. A new Software Librarian was subsequently located- Greg Dubuk KL7EV.

There was an ongoing discussion of the progress of the Totally Accurate Clock (TAC-2) development.

There was an ongoing discussion of the progress of the NSF Grant.

There was an ongoing discussion of the 1997 DCC to be held in the D.C. area. In contrast to the original proposal, the DCC will now be held 10/10-12/97 at the Holiday Inn near the BWI Airport.

10/20/96 - Motion to "Do the MIC-E with Gwyn (Reedy of PacComm) by Steve Bible N7HPR. Seconded by Jim Neely WA5LHS. Motion was carried.

10/26/96 - While no formal motions emerged, there was extensive discussion of a "Flame" against TAPR posted to several e-mail lists. Barry Mel amon VE3JF volunteered to write a rebuttal and post it to the same e-mail lists. Barry's message appeared to have the desired effect of blunting the worst of the attack on TAPR.

11/5/96 - Changes to the TAPR APRS e-mail list were discussed. The original APRS e-mail list was changed to an APRS Developer's list, and a Beginner's list, and a Bulletin-only list were created.

11/8/96 - The TAPR Spread Spectrum STA is granted with a period of six months. Discussion on the STA was moved to the SS-STA e-mail list.

11/25/96 - First mention that the ARRL would be dropping Digital System listings from the Repeater Directory, ultimately culminating in the TAPR North American Digital Systems Directory.

11/27/96 - Motion "That TAPR setup a committee to collect, organize, and disseminate digital listings. That this committee will begin to work with the various regional groups to make this possible. Also, that TAPR write a joint statement with the ARRL stating the fact that TAPR working with the various participating regional groups and the ARRL will take the lead on this digital listing issue and will begin to make information available in the near future." by Greg Jones WD5IVD. Seconded by Mel Whitten K0PFX. Motion was carried.

12/10/96 - Motion by Steve Bible N7HPR to "Fund the second alpha run of the TAC-2) to the tune of -$700.00". Seconded by John Ackermann AG9V. Assumed to be withdrawn upon the statement from Greg Jones WD5IVD that "Since we have already passed a project motion on the TAC-2, I don't think we need to vote again on a funding issue."

12/25/96 - Discussion of the death of the International Digital Radio Association and what actions, if any, were appropriate.

12/24/96 - Discussion on aspects of the MIC-E project being considered proprietary.

12/30/96 - Discussion of the first signs of trouble with FreeWave Technologies, Inc., culminating in the termination of the deal to buy FreeWave Spread Spectrum Wireless Modems at a substantial discount for TAPR SS-STA members.

1/4/97 - Discussions began on the TAPR 1997 BoD elections, and the first-ever electronic balloting for TAPR.

1/31/97 - Discussions began on Randy Roberts KC6YJY's Proposed SST-1 SS Radio-Modem for Ham Radio Applications. There were numerous concerns expressed with Randy's proposal. One of the primary concerns is the existence of a "3 year non-exclusive license" clause. What happens after 3 years is indetermined. Another is that Randy specifically states that the license is for Amateur use only - any commercial or educational use without renegotiation of the license is not permitted (likely a problem for future derivatives of this design that TAPR may wish to license. Another concern is that Randy's design is somewhat unfinished and requires further development. No team of volunteers has come forward to implement Randy's design.

2/13/97 - Discussion of the use of RealVideo on www.tapr.org. No motions made on buying the RealVideo software.

2/17/97 - An ongoing discussion began on the move of TAPR's Kilting Operation to the WA5VMS in Tulsa, Oklahoma. Subsequent discussions involved insurance coverages at the old and new locations.

2/27/97 - Motion by Greg Jones WD5IVD that "TAPR terminate the TAPR/AMSAT DSP-93 Joint DSP Development Project MOU (Memorandum of Understanding) and accepts a check for $2,479.88 as the conclusion of the project." Seconded by Jim Neely WA5LHS. Motion was carried.

3/8/97 - Planning for TAPR's Dayton activities kicks into high gear, beginning with discussion of reserved rooms.

3/9/97 - With concurrence from Greg Jones WD5IVD, Dewayne Hendricks WA8DZP renamed the "TAPR Regulatory Committee" to the "TAPR Regulatory Affairs Committee". Dewayne felt that the new name is a much better name for the committee's actual functions.

3/16/97 - Year End Financial Statements posted by Jim Neely WA5LHS.

3/17/97 - Motion by Greg Jones WD5IVD that "Based on the request from Dewayne Hendricks, I would like to make a motion that TAPR pursue becoming a sponsor of NRL (Nomadic Research Labs, aka Steve Roberts). Any money spent on this activity must be approved by the BoD. It is not anticipated that money would have to be spent. That TAPR would help with wireless issues - probably via Dewayne, Mike Chepponis, and other TAPR members near the NRL labs. Seconded by Jim Neely WA5LHS. The motion was carried.

3/30/97 - Discussion on extending the period of electronic balloting through the reception of the ballots arriving in Denton, forwarded from the Tucson P.O. Box. All discussion was favorable.

4/3/97 - Greg Jones WD5IVD posted a synopsis of a discussion with Phil Anderson of Kantronics.

4/15/97 - Motion by Greg Jones WD5IVD that the BoD travel reimbursement policy passed at the last BoD meeting be amended as follows: "TAPR Board and Exec Committee travel to Board meetings are budgeted and decided for the upcoming meeting, or year, and will be tied to the organization's income (lean year, no travel budget, etc.). For Dayton 1997 members of the BoD and Exec Committee travel, 50% of room cost, and 50% of airfare not to exceed $200. $200 figure is for airfare alone. Seconded by Jim Neely WA5LHS. The motion was carried.

4/20/97 - John Hanson WA0PTV requested the use of www.tapr.org as an FTP site for his newly-developed software called HamWeb. HamWeb is designed to be a general purpose file server using a broadcast protocol. HamWeb does not make use of the PacSat broadcast protocol. Subsequent discussion was in agreement that TAPR should assist John in his efforts to beta test and promote HamWeb.

ARRL and TAPR 16th Annual Digital Communications Conference

October 10 - 12, 1997 * Baltimore, Maryland

http://www.tapr.org/dcc

Information

The 1997 DCC will be held **October 10-12, 1997 in Baltimore, Maryland.**

Not only is the Digital Communications Conference technically stimulating, it is a weekend of fun for all who have more than a casual interest in any of the ham digital communications modes. This includes APRS operators, networkers, DX-Cluster Sysops, software writers, modem designers, and digital satellite communications enthusiasts. The ARRL and TAPR Digital Communications Conference is for all levels of digital operators – a must conference to attend to get active on a national level. Now, more than ever, amateur radio needs this great meeting of the minds, since it is important that we demonstrate a continued need for the frequency allocations we now have by pushing forward and documenting our achievements. The ARRL and TAPR Digital Communications Conference is one of the few ways to record our accomplishments and challenge each other to do more.

The Digital Communications Conference is a forum for radio amateurs and experts in communications, networking, and related technologies to meet, publish their work, and present new ideas and techniques for discussion. Presenters and attendees will have the opportunity to exchange ideas and learn about recent hardware and software advances, theories, experimental results, and practical applications. If you are doing HF, VHF/UHF, APRS, Spread Spectrum, Digital Voice and Video or other digital communications, then the 1997 ARRL and TAPR Digital Communications Conference is for you.

A Conference for the Beginner as well

The conference is not just for the digital expert. This year's conference will again provide an entire session strand with beginning, intermediate, and advanced presentations on selected topics in digital communications. Some of the topics will include: APRS, Satellite Communications, TCP/IP, Digital Radio, Spread Spectrum and other introductory topics. Come to the conference and hear these topics presented by the experts! Don't miss this opportunity to listen and talk to others in this area.

Workshops

In addition to the presentation of papers on Saturday, three symposiums/seminars will be held before and after the conference. For those that might have interest in just a symposium or seminar, registration for the conference is not necessary to register and attend one or more of the symposiums and seminars. This allows maximum flexibility for those that might want to participate during the Digital Communications Conference.

A full-day symposium on Friday covering APRS will be conducted by Bob Bruninga, WB4APR (father of APRS), Keith Sproul, WU2Z, Mark Sproul, KB2ICI (developers of Mac and Windows APRS), Steve Dimse, K4HG (developer of javAPRS), and other nationally known APRS developers. Join this group for the afternoon and evening for in depth discussions and presentations on the current and

Local Hosts

The 1997 ARRL and TAPR Digital Communications Conference will be co-hosted by AMRAD (Amateur Radio Research and Development Corporation).

The Amateur Radio Research and Development Corporation (AMRAD) is a worldwide club of amateur radio and computer experimenters whose purpose is to develop skills and knowledge in radio and electronic technology, advocate design of experimental equipment and techniques, promote basic and applied research, organize technical forums and symposiums, collect and disseminate technical information, and provide experimental repeaters. http://www.amrad.org

Call for Papers

Anyone interested in digital communications is invited to submit a paper for publication in the Conference Proceedings.

Presentation at the Conference is not required for publication.

Papers are due by August 20th, 1997, and should be submitted to:

ARRL, c/o Maty Weinberg
225 Main Street
Newington, CT 06111

or you can send in an electronic version via the Internet to **lweinberg@arrl.org**

Information on paper submission guidelines are available on-line. http://www.tapr.org/dcc.

future status of APRS. This is a unique opportunity to gain insight into this fast growing digital aspect of amateur operations that combines computers, packet radio, and GPS (Global Positioning System).

Starting late Friday afternoon a half-day seminar entitled "RF Basics for Computer Weenies: Helping the RF-challenged get the most out of the new high-speed wireless toys" will be conducted by Mike Chepponis, K3MC, on such topics as basic antenna types and their characteristics, comparison of feedlines and connector types, propagation basics (calculation of path loss, multipath effects, fresnel zones, etc), weatherproofing, lightning protection, filters, basic RF measurements, and other issues related to maintaining radio equipment on the UHF/SHF bands.

On Sunday morning, Dewayne Hendricks, WA8DZP, Phil Karn, KA9Q, and Tom McDermott, N5EG, will conduct a seminar focusing on "Spread Spectrum system design and theory." All three presenters are well known for their work in various areas of amateur digital communications and this 5 hour seminar should be an excellent opportunity to learn about the design and theory of spread spectrum systems.

Hotel

Conference presentations, meetings, and seminars will be held at the Holiday Inn BWI Airport. DCC special rooms rate is $89 per night. When making reservations with the hotel, be sure to indicate you are attending the ARRL and TAPR DCC conference to get the discount. It is highly recommended that you book your room prior to arriving - **a block of 75 rooms is reserved until September 9th, 1997**. After the 75 rooms are booked, rooms will only be available in nearby hotels. **Be sure to book your rooms early!** The hotel provides transportation to and from BWI Airport, nearby Amtrak/MARC rail station, and the local Baltimore Light Rail. Please contact the hotel to arrange specific transportation needs.

Holiday Inn BWI Airport (conference hotel)
890 Elkridge Landing Rd, Linthicum, MD, 21090
(410) 859-8400, Fax (410) 684-6778

What can you expect in 1997!

* A full day of papers and breakouts for the beginner to the advanced
* Three seminars/symposiums
* A banquet with Special Guest Speaker (TBA).
* Informal get-togethers throughout the weekend.
* TAPR Membership Meeting
* An event at which the most important new developments in amateur digital communications are announced.
* Digital 'movers and shakers' from all over the world in attendance.

Conclusion

There are few activities where your participation can be so much fun and important! What a great way to share and renew your enthusiasm for digital amateur radio! A get-together with colleagues and bringing each other up to date on your latest work -- all this, and more, for an unforgettable weekend of amateur radio and digital communications. We hope to see you at the ARRL and TAPR Digital Communications Conference on October 10-12!

Full information on the conference and hotel information can be obtained by contacting Tucson Amateur Packet Radio. Phone: (940) 383-0000, Fax: (940) 566-2544, Internet: tapr@tapr.org Web: www.tapr.org

Registration Form

Contact the TAPR office by Phone 940-383-0000, Fax 940-566-2544, or Internet: http://www.tapr.org/dcc and tapr@tapr.org to register or for additional information.

- Pre-Registration (before Sept 10th) $42.00 _____
- Registration (after Sept 10th) or at door $47.00 _____

Conference Registration includes:
Conference Proceedings, Sessions, Meetings, and Lunch on Saturday.

- Saturday Evening Dinner $20.00 _____
(Limited Space) Place Drawing
Dinner, Banquet Speaker Yutaka Sakurai

Seminars/Symposiums

- APRS, Friday, 1pm - 8pm. $25.00 _____
Conducted by: Bob Bruninga, WB4APR,
Keith Sproul, WU2Z Mark Sproul, KB2ICI,
Steve Dimse, K4HG - Symposium Coordinator

- RF Basics for Computer Weenies
Friday, 3pm - 7pm. $20.00 _____
Conducted by Mike Chepponis, K3MC

- Spread Spectrum System Design and Theory
Sunday, 12noon-5pm $20.00 _____
Conducted by: Dewayne Hendricks, WD8DZP,
Tom McDermott, N5EG, and Phil Karn, KA9Q

TOTAL _____

Name (full): _____

Street Address: _____

City, State/Zip: _____

County: _____ Phone number: _____

Internet E-mail: _____

☐ Charge my credit card (check one):
☐ VISA ☐ MasterCard

Acct. #: _____

Expiration Date: _____

Signature on card: _____

Mail completed registration form with check to:

TAPR
8987-309 E Tanque Verde Rd #337
Tucson, Az 85749-9399

or check http://www.tapr.org/dcc for an on-line registration form.

A registration packet will be mailed in September upon receipt of registration form and payment.

Tucson Amateur Packet Radio
8987-309 E. Tanque Verde Rd #337
Tucson, Arizona • 85749-9399
Office: (940) 383-0000 • Fax: (940) 566-2544
Internet: TAPR@TAPR.ORG • www.tapr.org
Non-Profit Research and Development Corporation

July 1997

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

Kits	Price	Qty	Total	Kit Code	Information
DSP-93 w/ wall transformer	$430.00			16	check with office on ship date, no discount
TAC-2 (Totally Accurate Clock)	$139.00			10	
Garmin GPS-20 Interface/Power	$35.00			8	
Oncore VP Interface/Power	$35.00			8	
DAS (DTMF Accessory Switch)	$68.00			5	limited availability. As low as Dec '96 QST
AN-93 HF Modem	$90.00			5	limited kits available.
TAPR 9600 bps Modem	$80.00			6	
Bit Regenerator	$10.00			1	used for regenerative repeater operation
Clock Option	$5.00			1	used for regenerative repeater operation
PK-232 Modem Disconnect	$20.00			3	simplifies connection of external modems
PK232MBX Installation Kit	$20.00			2	for purchase of 9600 modem in PK-232MBX
XR2211 DCD Mod.	$20.00			2	
State Machine DCD Mod.	$20.00			2	
State Machine DCD w/Int Clock	$25.00			2	for PK-232 or other TNCs with 16K or 32K memory
METCON-1 Telemetry/Control					Version 1 kits no longer available.
Voltage-to-Frequency module	$30.00			3	Plenty of the Option Kits!
Temperature-to-Freq module	$40.00			3	
A-D Converter	$45.00			3	
Elapsed Time Pulser	$35.00			3	
Firmware					
32K RAM w/ TNC2 update docs	$20.00			3	
TNC-2 1.1.9 w/KISS EPROM	$15.00			4	includes 1.1.9 Commands booklet (below)
1.1.9 Commands Booklet (only)	$8.00			3	full TNC-2 command set for 1.1.9
TNC-2 WA8DED EPROM	$12.00			3	1 current version for AMSDos systems
TNC-1 WA8DED EPROM	$12.00			3	
TNC-2 KISS EPROM	$12.00			3	
TNC-1 KISS EPROM	$12.00			3	
PK-87 WA8DED EPROM	$12.00			3	
Publications					
1997 TAPR CD-ROM	$20.00			4	60 9660, 650 Megs of info! w/ html nav pages
Wireless Digital Communications	$39.99			8	300+ pages w/disk by Tom McDermott, N5EG
Packet Radio: What! Why! How!	$12.00			7	130 pages. TAPR's Packet Radio book
BBS Sysop Guide	$9.00			2	60 pages. by Barry Boslow, WA0RJT
TAPR's 94 Annual Proceedings	$7.00			7	Papers from the Annual Meeting (Boston)
TAPR's 95 Annual Proceedings	$7.00			7	Papers from the Annual Meeting (St Louis)
PSR Set Vol 1 (#1 - #17 '82 - '85)	$20.00			0	
PSR Set Vol 2 (#18 - #36 '86 - '89)	$20.00			0	
PSR Set Vol 3 (#37 - #52 '90 - '93)	$20.00			0	
NOSIntro, Intro to KA9Q NOS	$23.00			0	by Woh, G3NRW, TCP/IP over Packet Radio
ARRL CNC Proceedings 1st - 15th	call			.	Individual Proceedings, call for prices
Entire Set ARRL DCC 1st - 15th	$110.00			149	10 Proceedings from 1981 to 1994
Other					
TAPR 11oz Coffee Mug logo	$11.00			4	Logo in black and microwavable gold
TAPR Badge	$10.00			0	include Name and Call for badge
TAPR Shirt - 4 styles					http://www.tapr.org/tapr/html/shirts.html
3 1/2" Disk from TAPR Library	$3.00			0	$3 per disk. See TAPR Software Library List
Garmin GPS-20 (Member Price)	$169.00			28	No Discount. Check with office about next buy
Oncore VP GPS (Member Price)	$269.00			28	No Discount. Check with office about next buy

Subtotal: _____ _____ **Added Total Kit Codes**

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

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

○ Renewal ○ New Member

_____ **SubTotal**

_____ **Membership 10% Discount**
Except were noted Member #: _____ (Place new if joining)

_____ **Total Sales (Subtotal minus discount)**

_____ **Texas Residents (7.75% tax)**

_____ **Membership (New or Renewal)**

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

1 - 3	4 - 7	8 - 15	16 - 27	28 - 55
Add $3	Add $4	Add $5	Add $6	Add $7

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

_____ **TOTAL Order Amount**

☐ Charge my credit card (check one):
☐ VISA ☐ MasterCard

Acct. #: _____
Expiration Date: _____
Signature on card: _____

Name / Call: _____

Street Address: _____

City / State / Zip: _____

Country: _____ Phone Number: _____

Internet E-mail: _____