President's Corner

Hamvention with TAPR

By Steve Bible, N7HPR

Hamvention is nearly here and TAPR will be present in full-force! The biggest ham radio convention of the year runs from May 15 to May 17 in the Greater Dayton, Ohio metroplex and TAPR has plans for the event to fill your weekend.

Booths

TAPR's suite of booths will be in the Ballarena section of HARA at booths 451 through 454 (the same location as last year) where we will be showing what we have been up to lately. Our booths and other inside exhibits will be accessible 9 AM to 6 PM on Friday and 9 AM to 5 PM on Saturday from 9 AM to 1 PM on Sunday.

Board Meeting

The Hamvention in-person TAPR Board of Directors meeting will be Thursday evening at The Hilton Garden Inn Dayton South/Austin Landing, 12000 Innovation Drive, just off I-75 (exit 41) south of downtown Dayton. All TAPR members are invited to attend the meeting and speak their piece. The meeting starts at approximately 7 PM.

TAPR Forum

Friday morning, Scotty Cowling, WA2DFI, will moderate the TAPR Forum in Room 1 of the HARA Arena starting at 9:15 AM.

This years' TAPR Forum speakers include:

• TAPR President Steve Bible, N7HPR's "Introduction"

• Steve Ford, WB8IMY 's "Write for *QST*"

• Bill Curtice, WA8APB and Bob Dixon, W8ERD on "Hamnet Mesh: Consider the Possibilities!"

• Bryan Fields, W9CR on "High Speed IP Radio"

• Chris Testa, KD2BMH on "Whitebox Project: New Charlie Prototype"

• Michael Ossman/AD0NR on "Spectrum Monitoring with Software Defined Radio."

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

The full description for the TAPR Forum follows this article.

Dinner

The annual TAPR-AMSAT takes place on Friday evening at the Jefferson Room, Kohler Presidential Banquet Center, 4572 Presidential Way, Kettering, OH 45429.

Attendees will digest a delicious dinner (menu below) while listening to Michael Ossman, AD0NR, give an after-dinner speech, "Adventures of a Hacker Turned Ham."

Michael Ossman grew up as a computer nerd embracing the hacker ethos. Eventually he became very interested in the security of wireless systems such as remote keyless entry, garage door openers, Wi-Fi and Bluetooth. He designed Ubertooth One, a Bluetooth sniffer that was successfully funded on Kickstarter. Not one to rest, Michael later designed and successfully funded HackRF One, an open source SDR platform that attracted the attention of the Amateur Radio community. Michael will talk about his unique perspective on that community as an outsider looking in, why he resisted getting a license for years, and why he finally decided to join. He will also share his thoughts on what it means to be a hacker, what it means to be a ham, and what Amateur Radio may look like in the decades to come.

Doors open to a cash bar at 6:30 PM and dinner begins at 7 PM. Reservations are required and must be made by 6 PM on Tuesday, May 12. Purchase tickets for $35 online at the AMSAT store

< http://tinyurl.com/kwlbbhu>. Reserved tickets can be picked up at the AMSAT booth (433-435, 444-446) on Friday.

Here is the Dinner Menu:

- Prime Rib of Beef
- Chicken Piccata with Lemon Caper Sauce
- Medallions of Grilled Pork Tenderloin
- Fresh Mashed Potatoes
- Wild Rice Pilaf with Pecans and Apricots
- Fresh Garden Tossed Salad
- Rolls
- Assorted Cakes and Cheesecakes
- Coffee and Ice Tea

The Crew

Most of the guys and gals behind the scenes at TAPR will be in attendance at the Hamvention, so you will have an opportunity to say "Hello" and have an eyeball QSO with the TAPR crew.

I hope to see you in Dayton!

73,

Steve, N7HPR

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2015 Hamvention TAPR Forum Schedule

Friday, May 15, 2015

Moderator: Scotty Cowling, WA2DFI

Bio: Scotty was first licensed in 1967 and has been continuously active since that time. He is active while mobile on HF CW and on APRS. Scotty is an advisor for Explorer Post 599, a BSA affiliated ham club for teens in the Phoenix area. He has been involved in the openHPSDR project for the last 9 years, and is a past TAPR Director and past TAPR Vice President. Scotty is also active in the production of openHPSDR components and other SDR projects. He is a co-founder of iQuadLabs, LLC, a supplier of openHPSDR systems and other Software Defined Radio components. He currently works at Zephyr Engineering, Inc, a computer consulting company that specializes in FPGA design and SDR hardware.

Friday, May 15, 2015

9:15 – 9:25 AM

"Introduction" by Steve Bible, N7HPR, TAPR President

9:25 – 9:35 AM

"Write for *QST/QEX*" by Steve Ford, WB8IMY, *QST* Editor

9:35 – 10:00 AM

"Hamnet Mesh: Consider the Possibilities!" by Bill Curtice, WA8APB and Bob Dixon, W8ERD

Abstract: High speed, digital, microwave mesh networks offer hams an exciting array of new communications possibilities supporting experimentation, remote sensing and control, and emergency communications. Mesh is the ultimate "experimenter's sandbox", serving as an ideal host for a wide variety of "maker" projects and applications. This presentation will introduce mesh, describing what it is, how it works, and how it's deployed. We will then address a variety of mesh applications, to include those hosted by Raspberry Pi and similar processors.

Bios: Bill Curtice, WA8APB: Bill leads the Miami Valley Mesh Alliance, a local Dayton area organization supporting hams using mesh technology. He also serves as the digital coordinator for the Greene County ARES. An electrical engineer by profession, Bill's ham radio interests have focused on digital communications for the last few years.

Bob Dixon, W8ERD: Bob is an active participant in the Delaware County High Speed Multimedia group, supporting mesh technology. He served as Emergency Coordinator of Central Ohio for 10 years, and received the ARRL Technical Service Award in 2013. He is a retired Electrical Engineer and Radio Astronomer from Ohio State University. Most recently he has constructed portable and mobile mesh stations to link mesh, cell phones and conventional radio systems together.

10:00 – 10:25 AM

"High Speed IP Radio" by Bryan Fields, W9CR

Abstract: A presentation on High-Speed IP radio with an emphases on building regional highly available networks. Utilizing the same techniques which enable the Internet, Amateur Radio networks may be built; connecting projects to the Internet or other sites. These networks form a resilient backup to cable, DSL and phone commercial internet connections.

Bio: Bryan Fields, W9CR has been a licensed Amateur Radio operator for 20+ years. He serves on the Technical Committee of AMPRnet, and

as president of Florida Simulcast Group, Inc., a 501(c)3 amateur repeater club. He is a Sr. Consulting Engineer with Alcatel-Lucent, and has over a decade in the telecommunications industry. At ALU he is focused on wireless data performance in carrier networks and IP/MPLS networking.

10:25 – 10:50 AM

"Whitebox Project: New Charlie Prototype" by Chris Testa, KD2BMH

Abstract: Come check out the third prototype of the Whitebox handheld SDR project. This is a software-defined transceiver that will be FCC-legal and can communicate using essentially any mode and protocol up to 1 MHz wide on frequencies between 50 and 1000 MHz. It pairs with your smartphone, and runs all Open Source Software on an embedded uClinux system.

Bio: Chris Testa, KD2BMH got his degree in Computer Engineering from the University of Maryland. His day job is building Cloud based services, and by night his passion is to design and build computer hardware. Chris lives in Los Angeles and likes to go backcountry camping.

10:50 – 11:15 AM

"Spectrum Monitoring with Software Defined Radio" by Michael Ossmann, AD0NR

Abstract: Many of the current crop of SDR platforms support a very wide range of operating frequenciescovering more than a GHz of bandwidth, but most users of those platforms find themselves looking at waterfall displays showing a few MHz at most. Let's look at how we can use SDR to monitor activity over several GHz of spectrum and visualize the results over both short and long periods of time.

Bio: Michael Ossmann is a wireless security researcher who makes hardware for hackers. Best known for the open source HackRF, Ubertooth, and Daisho projects, he founded Great Scott Gadgets in an effort to put exciting, new tools into the hands of innovative people.

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TAPR Calendar
2015

May 14 – Board of Director In-Person Meeting, Dayton, OH

May 15-17 – Dayton Hamvention

May 15 – TAPR-AMSAT Annual Dinner, Dayton, OH

Aug. 1 – *PSR* #129 issue deadline

Aug. 15 – *PSR* #129 issue publication date

Oct. 8 – Board of Director In-Person Meeting, Chicago, IL

Oct. 9-11 – Digital Communications Conference, Chicago, IL

Nov. 1 – *PSR* #130 issue deadline

Nov. 15 – *PSR* #130 issue publication date

###

DCC in Chicago
October 9-11

The 2015 ARRL-TAPR Digital Communications Conference (DCC) will be held in the Chicago area on the weekend of October 9-11, 2015.

DoubleTree by Hilton Chicago - Arlington Heights <http://www.doubletreeah.com/> at 75 W. Algonquin Road, Arlington Heights, Illinois, 60005 is the site of the DCC with rooms available at $99 per night and a free shuttle to and from O'Hare International Airport.

On-line, you can register for the DCC and make your hotel reservations here:

https://www.tapr.org/dcc.html

Technical papers for presentation at the DCC and publication in the Conference Proceedings must be submitted by August 17 to:

Maty Weinberg, ARRL

225 Main Street

Newington, CT 06111

Do not attach ZIP files, as these will be rejected by the ARRL e-mail server. Technical paper details and guidelines are available here:
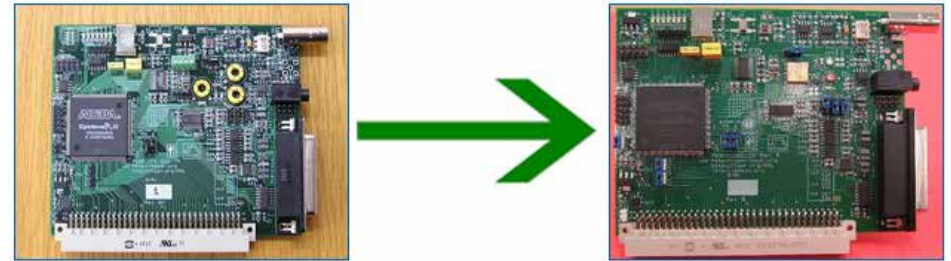
https://www.tapr.org/dcc.html#dcccallforpapers

###

Penelope to PennyLane
Trade-In Program

HPSDR Enthusiasts: This is your opportunity to upgrade your Penelope board for a PennyLane board for only $199.

There are two ways to upgrade:

Hamvention Special

If you are attending the Dayton Hamvention this year, bring your Penelope board and $199 to the TAPR booth (booths 451-454) and we will swap it for a new PennyLane board.

Otherwise

If you are NOT attending Hamvention, order a PennyLane board here <http://www.tapr.org/kits_pene-trade.html> and along with the shipment of your PennyLane board, you will be issued a return authorization to ship your Penelope board back to TAPR. Upon receipt of your Penelope board (in satisfactory condition), $200 will be refunded to your credit card.

Sorry, but unless you will be making the trade-in at Hamvention, the upgrade program is currently limited to residents of the US.

###

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

2015 ARRL/TAPR Digital Communications Conference

October 9-11 in Chicago, Illinois

Make your reservations now for three days of learning and enjoyment at the DoubleTree by Hilton Chicago – Arlington Heights hotel. The Digital Communications Conference schedule includes technical and introductory forums, demonstrations, a Saturday evening banquet and an in-depth Sunday seminar. This conference is for everyone with an interest in digital communications—beginner to expert.

Call Tucson Amateur Packet Radio at: **972-671-8277**, or go online to **www.tapr.org/dcc**

# Near Space Flights as a Tool for STEM Education

By Paul Verhage, KD4STH

We've built much of our industrial and intellectual power on technology. However, our workforce, those who helped to build and extend our prosperity, is retiring or approaching retirement. In addition, we're competing with more nations with the interest of and ability to develop technology at home. The combination of an aging STEM workforce and growing international competition increases the risk that the US may fall nations like China, India, and South Korea. While it may not be possible to remain first in every economic measure forever, it's preferable that we at least remain equals with these nations rather than falling to second place. There are several reasons we're not maintaining as strong of a lead as we have in the past. However, increasing STEM education, both in the formal and informal settings, is one important step we can take – even if it's just to turn American kids into knowledgeable consumers and voters.

Amateur Radio has a history of delivering Science, Technology, Engineering, and Mathematics (STEM) experiences to the young and old alike. This article will briefly describe one of the newer ways that Amateur Radio operators can provide this service, high altitude ballooning or otherwise known as amateur near space exploration.

Near Space and BalloonSats

First off, what is near space and how do students explore it? Near space is that region of Earth's atmosphere that's above controlled air space (60,000 feet or flight level 600) and below the accepted standard boundary for outer space, 328,000 feet (a standard set by the International Aeronautical Federation). This a region not well explored throughout its range. Its lowest portions are accessible by weather balloon but only rockets can reach its upper region. This means the lower portions of near space are well studied since rockets are in a hurry to reach their ultimate destination.


Air Temperature
NearSys 15B
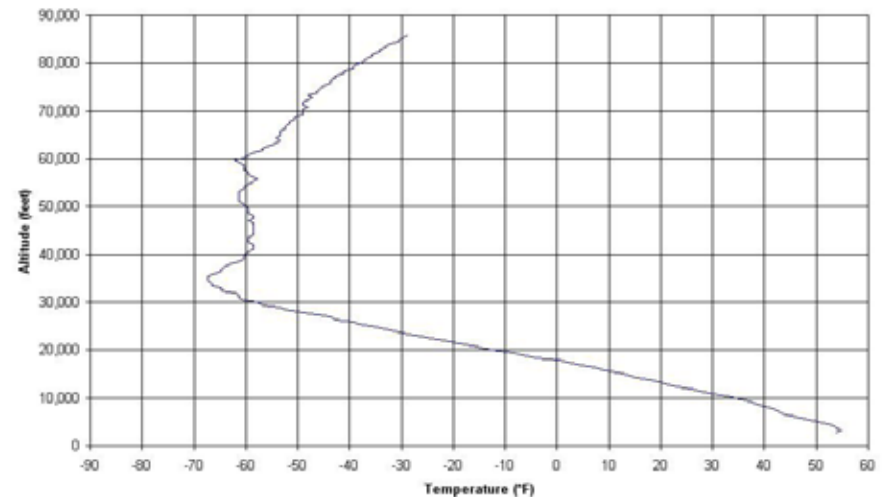
Students can be taught that the ozone residing within the stratosphere blocks dangerous ultraviolet radiation from the sun. And most will be able to correctly answer a question in this regard on their next test. However, chances are they won't remember this fact after the end of the semester. On the other hand, if their experiment collects temperature data like this, they're likely to question why the air temperature increased above 60,000 feet (since it's counterintuitive to what they've experienced). Now they're ready to learn that this is where the stratosphere begins and that ozone molecules within the stratosphere are blocking ultraviolet radiation by converting it into thermal energy. Since students derived the data and discovered the answer, they're more likely to remember it much later in life.

Air Pressure
NearSys 15B
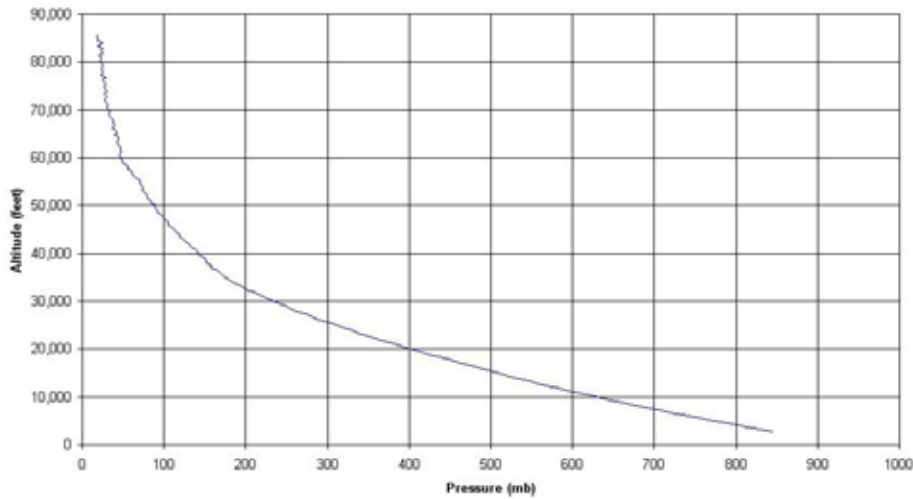
Relative Humidity
NearSys 15B
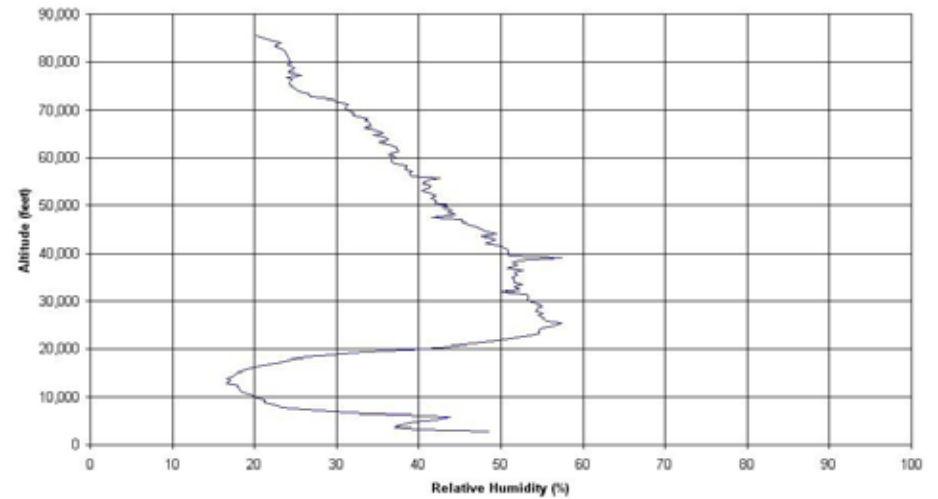
Two more examples of the data that even junior high school students can collect and analyze from a near space experiment.

Because of IGates, students without an Amateur Radio license can monitor the flight of their BalloonSat. Graphing the position reports lets them create models of their BalloonSat's flight in Google Earth.

A typical flight path for a near spacecraft reaching an altitude of 85,000 feet. Notice that the wind changed direction and speed at about 60,000 feet. This is not atypical.

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Students develop near space experiments inside of BalloonSats, or balloon satellites. BalloonSats are functional models of satellites that consist of an airframe and avionics. The airframe is a box made of ½" thick Styrofoam that forms a lightweight and well-insulated container for the avionics. BalloonSat avionics consist of dataloggers and cameras that students design, build, and program to operate experiments and collect data. Designing, building, and testing an airframe gives students an experience in mechanical engineering and thermal design. The avionics gives students an experience in electronics, technology, and programming. The analysis of the BalloonSat data gives them science and math experience. BalloonSats are a well-integrated STEM experience that can be repeated multiple times.

Where the Amateur Radio Community Can Help

BalloonSats and a parachute is not the only payload that a weather balloon carries. If schools wish to track their mission and get their BalloonSats back, they'll need Amateur Radio operators to send an APRS tracking unit along with the balloon. The tracking unit contains a high altitude version of a GPS receiver, TNC, radio, antenna, and battery. The tracking unit can be quite simple, from consisting of a TinyTrak that transmits it position once a minute to a more complex flight computer incorporating two way communications to operate experiments and control vital aspects of the near space mission. In any case, the tracking unit must be able to handle the cold temperature of near space and operate autonomously for at least four hours (if not for a day). For the rest of this article I'll describe a simple airframe for an APRS tracker that hams can build and use to fly BalloonSats for their local schools.

From top to bottom, a weather balloon, parachute, two APRS trackers (the second one is for redundancy), and eight student-designed BalloonSats begin a mission to explore near space.

Building a Near Space Tracker

The airframe of a near space tracker is a soft-sided lunch cooler. Building a Near Space Tracker. Correplast or corrugated plastic provides support structures for the APRS tracker and antenna. Urethane foam rubber provides extra insulation and cushioning, and materials like nylon straps, nuts, bolts, washers, and split metal rings tie everything together.

The tracker resembles a layer cake. In the bottom of the lunch cooler is a thick sheet of foam rubber, followed by the avionics deck with an attached APRS tracker, a layer of foam rubber over the APRS tracker, and finally the GPS receiver.
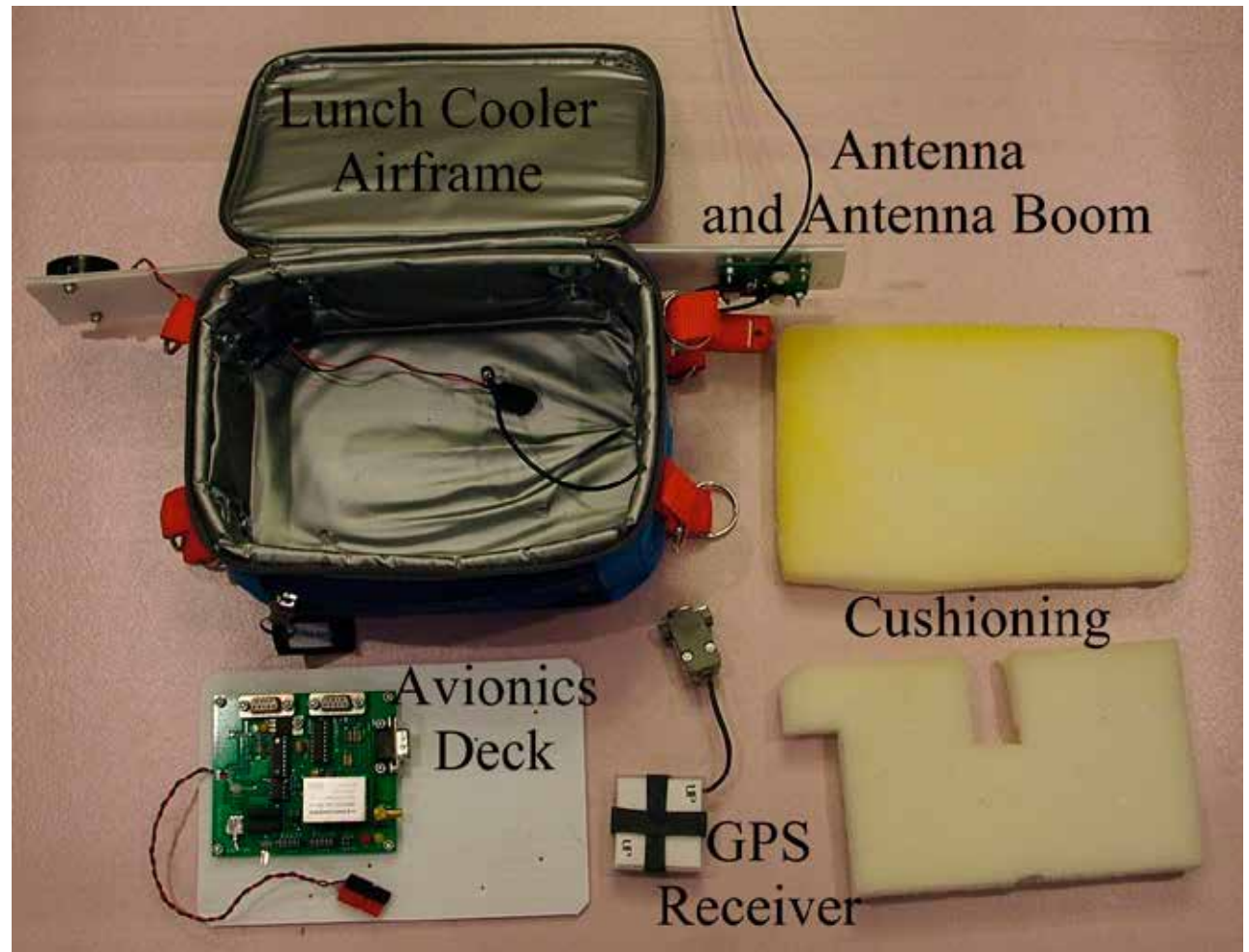
An example of a near space tracker that hams can use to bring an "Out of this World" STEM experience to their community.
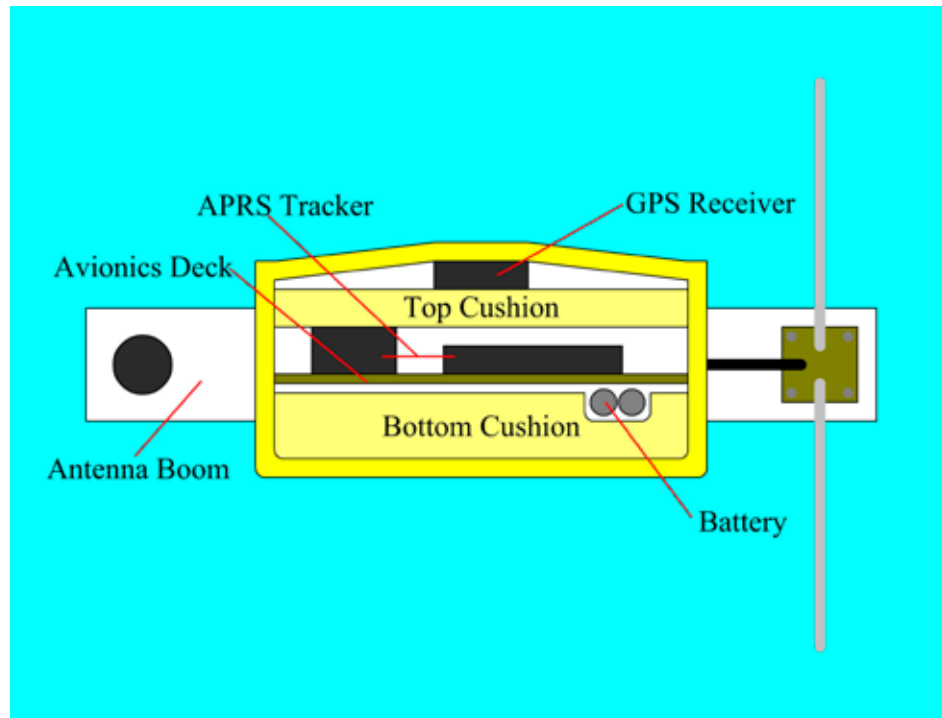
A cross section view of the layered cake arrangement of components making up a simple APRS tracker for near space.

The bottom foam rubber layer provides cushioning and insulation to the electronics above it. The avionics deck is a sheet of Correplast and provides a rigid surface in which to mount the APRS tracker. The tracker must be solidly mounted to the Avionics Deck because at balloon burst and during the initial descent, things get really chaotic for the near spacecraft. Anything not tied or bolted down is liable to bounce around

damaging the tracker. Believe me, there's nothing worse than losing contact with a near spacecraft at its highest altitude. On top of the tracker is another layer of foam rubber that sandwiches the GPS between it and the lid of the lunch cooler.

An Antenna Boom attaches the antenna to the tracker. The boom is a strip of Correplast plastic (with its cells running horizontally for stiffness) bolted to the back of the lunch cooler with bolts, fender washers and nylocks. Also bolted to the cooler are four nylon straps. The straps are folded over with a one inch overlap to create loops at the top and bottom of the lunch cooler for attaching one inch diameter split metal rings.

Now program the APRS tracker and test. If you shake the near space tracker hard and it holds together and continues transmitting, it's passed it's the shake test. Next try placing inside the freezer for four hours. If it continues transmitting when it's cold, it's passed the cold test. Then let it transmit for at least four hours and preferably longer. If the battery voltage still looks good, it's passed the flight test. You've got yourself a near space tracker capable of carrying student experiments into near space.

I hope this is enough to convince readers that near space flights are a real possibility for any ham. There's still things you'll need to know, like how to fill balloons, predict flights, and connect all the modules together. However, once you have a near space tracker, the rest of it is easy. If you would like to pursuit this further, then check out my website http://www.nearsys.com and contact me at nearsys@gmail.com. Before you know it, you'll be chasing balloons across the county for local school students.

###

Build a Better Demodulator for APRS / AX.25 Packet

By John Langner, WB2OSZ

⚠

These are not professionals on a closed course.

You CAN try this at home.

Sometimes it's a little mystifying why an APRS / AX.25 Packet TNC will decode some signals and not others. A weak signal, buried in static, might be fine while a nice strong clean sounding signal is not decoded. Here we will take a brief look at what could cause this perplexing situation and a couple things that can be done about it.

Demodulator Basics

The most common method for transmission of AX.25 Packet Radio is based on the old Bell 202 standard. Data is sent at 1200 bits per second using two different audio frequencies: 1200 & 2200 Hz, often called "mark" and "space," to represent the logic 1 and 0 values. This is called audio frequency shift keying (AFSK). A demodulator needs to listen for those two tones and decide which one is stronger.

Here is the general idea for one type of demodulator:
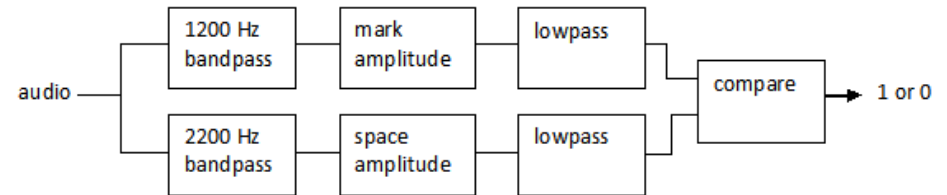
We start off with a bandpass filter for each of the audio frequencies. In the old days, you might use an inductor and capacitor. Later we progressed to active filters with op amps. Today it can be done in software.

What we are interested in is the amplitude of the tone, not the sine wave. In the old days, this would be a full wave rectifier. The software equivalent is taking the absolute value so the negative peaks become positive.

A low pass filter allows the lower speed data through while removing the higher frequency ripple and noise.

Finally, we have a comparator to decide which tone is stronger and the result is logic 1 or 0. This goes to an HLDC decoder that looks for patterns in the bit stream and spits out groups called "frames."

This type of demodulator is not that hard to implement and works well for ideal signals. Unfortunately, we don't hear too many ideal signals, so it becomes a little more challenging. The problem is that we are sending digital data through transceivers designed for voice. The audio circuits designed to improve the intelligibility of the human voice distort the data and make it less likely to be decoded properly.

A Look at Ideal Signals

First let's start off looking at the characteristics of an idea signal. We will generate some ideal frames and decode them. You might want to follow along at home and try some variations on these. You will need Dire Wolf version 1.2, which is still under development when this is being written. This is still evolving so the exact appearance and numbers could change, but the principles illustrated remain the same.

```
gen_packets -o test1.wav
atest test1.wav

DECODED[1] WB2OSZ-15 audio level = 49(50/51)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  1 of 4

DECODED[2] WB2OSZ-15 audio level = 49(51/51)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  2 of 4

DECODED[3] WB2OSZ-15 audio level = 49(51/50)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  3 of 4

DECODED[4] WB2OSZ-15 audio level = 49(51/51)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  4 of 4
4 packets decoded in 0 seconds.
```

"gen_packets" generates some AX.25 frames, converts them to audio, and puts the result in the specified file. "atest" reads the audio file and extracts the frames.

In each case, we see an audio level composed of 3 parts:

- Received audio signal level.
- Strength of the mark tone.
- Strength of the space tone.

Notice how they are all quite close.

Add Some Noise

Next we will generate 100 frames with increasing levels of random noise and try to decode them. Most of the resulting output was omitted to save space.

```
gen_packets -n 100 -o test2.wav
atest test2.wav

DECODED[1] WB2OSZ-15 audio level = 50(51/52)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  0001 of 0100

DECODED[2] WB2OSZ-15 audio level = 50(51/51)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  0002 of 0100

…

DECODED[26] WB2OSZ-15 audio level = 72(57/53)
[0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  0026 of 0100
```

```
DECODED[27] WB2OSZ-15 audio level = 75(56/59)
 [0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  0027 of 0100
 …


 DECODED[61] WB2OSZ-15 audio level = 109(68/61)
 [0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  0061 of 0100


 DECODED[62] WB2OSZ-15 audio level = 113(60/74)
 [0] WB2OSZ-15>TEST:,The quick brown fox jumps over the
lazy dog!  0064 of 0100


 …


 64 packets decoded in 1 seconds.
```

Notice how it starts off fine with little noise. All 3 audio levels are about the same. As the noise level increases, the overall audio input level goes up to more than double the original number. The mark and space filter outputs increase a little, because some of the wide-band noise gets through, and we notice larger inconsistencies between the levels. One or the other might be higher depending on the random noise. Eventually, we reach the point where the noise level is so high the frames can't be decoded.

When the first audio level number is significantly larger than the others, it indicates we have a poor signal to noise ratio.

The Real World

There is another reason why we see imbalances between the two tones even when no noise is present. You should find a very good explanation here: http://www.febo.com/packet/layer-one/transmit.html

Go read it now. I'll be waiting here, to continue, when you get back…..

The important points are,

• Microphone audio is "pre-emphasized" to boost the higher frequencies before transmission.

• Speaker audio is "de-emphasized" to attenuate the higher frequencies In theory these should cancel out.

• When the transmit audio level is set too high, limiting, which is applied after the pre-emphasis, causes a greater decrease in the higher (space) tone.

It gets worse.

• Some systems use a flat bandpass on transmit rather than boosting the higher frequencies.

• Some systems use a flat bandpass on receive rather than attenuating higher frequencies.

• When the sender and receiver use different conventions, the imbalance is even greater.

Playing with simulated signals can get us only so far. Let's look at some actual signals. WA8LMF did the ham radio community a great service by providing a collection of real-world imperfect signals that can be used for testing. Learn about it and download a copy from here: http://wa8lmf.net/TNCtest/

Track 1 has a flat response on receive.

Track 2 has the same thing with de-emphasis typical of many receivers. This has become the *de facto* standard for measuring TNC receive performance. Google for "tnc test cd" and you will find scattered test results.

When we examine the ratio of mark / space amplitude, we find:

Track 1: 0.53 to 1.38 with a median of 0.81.

Track 2: 1.73 to 3.81 with a median of 2.48.

Heard locally (from speaker): 1.48 to 3.41 with a median of 2.70.

My first naïve attempt at building a demodulator worked great on ideal signals but performance was very disappointing with real-world signals where there were considerable variations between the strengths of the mark and space tones.

Earlier Solution

My solution was to add an automatic gain control (AGC) for the mark and space amplitudes. This normalized both signals to the same level before making the comparison.
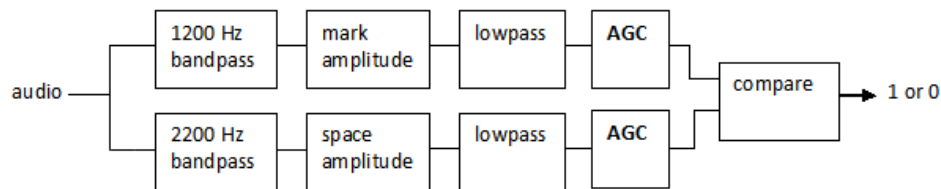
This works well, decoding 970 frames from Track 2 of the TNC Test CD. The "-P C" option, below, means use the default decoder parameters from version 1.1.

```
atest -P C 02_Track_2.wav


DECODED[1] Digipeater N6EX-5 audio level = 9(6/3)
 [0] WA6YLB-4>APRS,N6EX-5*:$ULTW00000000----0000----
000086A00001----0000000000000000<0x0d><0x0a>


DECODED[2] KD6FVP-2 audio level = 19(13/5)
 [0] KD6FVP-2>APS224,N6EX-1,WIDE1:>152343z[224]*We know
most of your faults!!!<0x0d>


...


DECODED[969] Digipeater N6EX-4 audio level = 13(5/3)
 [0] N6XQY-12>GPSLJ,N6EX-4*:$GPRMC,021841.28,A,3346.1449,N
,11755.4088,W,00.0,000.0,231105,13.,E*71<0x0d>


DECODED[970] Digipeater N6EX-4 audio level = 12(5/3)
 [0] KN6DB-14>GPSLK,N6EX-4*:$GPRMC,021851,A,3348.8470,N,11
800.1685,W,000.0,274.0,231105,013.4,E*6D<0x0d><0x0a>


970 packets decoded in 54 seconds.
```

The "E" decoder, new in version 1.2, adds a bandpass filter between the radio and the mark/space filters. This helps with noisy signals and gives us about another 18 frames. These numbers might vary a little as the application evolves.

```
atest -P E 02_Track_2.wav


DECODED[1] Digipeater N6EX-5 audio level = 9(6/3)
```

```
 [0] WA6YLB-4>APRS,N6EX-5*:$ULTW00000000----0000----
000086A00001----0000000000000000<0x0d><0x0a>

 DECODED[2] KD6FVP-2 audio level = 19(13/5)
 [0] KD6FVP-2>APS224,N6EX-1,WIDE1:>152343z[224]*We know
most of your faults!!!<0x0d>

 …

 DECODED[987] Digipeater N6EX-4 audio level = 16(3/1)
 [0] N6XQY-12>GPSLJ,N6EX-4*:$GPRMC,021841.28,A,3346.1449,N
,11755.4088,W,00.0,000.0,231105,13.,E*71<0x0d>
 DECODED[988] Digipeater N6EX-4 audio level = 16(2/1)
 [0] KN6DB-14>GPSLK,N6EX-4*:$GPRMC,021851,A,3348.8470,N,11
800.1685,W,000.0,274.0,231105,013.4,E*6D<0x0d><0x0a>
 988 packets decoded in 63 seconds.
```

Where did that 02_Track_2.wav file come from? Waiting 25 minutes and 49 seconds for each test would get boring quickly. The tracks were "ripped" from the TNC Test CD and saved in the WAV file format. This allows us to run each test in about a minute.

All of the demodulator parameters involve tradeoffs. We want the filters to be narrow to exclude undesired signals (noise) but they must be wide enough to let the desired signals through. The automatic gain control also involves tradeoffs in how quickly it changes gain in response to input signal changes. What might be optimal for one frame might not be as good for another.

Another Approach

4X6IZ had another interesting approach described in *QEX*:

http://www.tau.ac.il/~stoledo/Bib/Pubs/QEX-JulAug-2012.pdf

Two separate demodulators, tuned in different ways, are run in parallel. One has a pre-filter with flat response in the range of interest. The other boosts the space frequency by 6 dB. One decoder did better on Track 1; the other did better on Track 2. After removing duplicates, decoded by both, up to 966 frames were decoded.

The unfortunate consequence of running two completely separate demodulators is that it requires twice as much CPU power. The filters are very computationally intensive. An amplifier, comparator, and HDLC decoder take much less compute power. Here is little variation on the same idea that does not take significantly more computation.
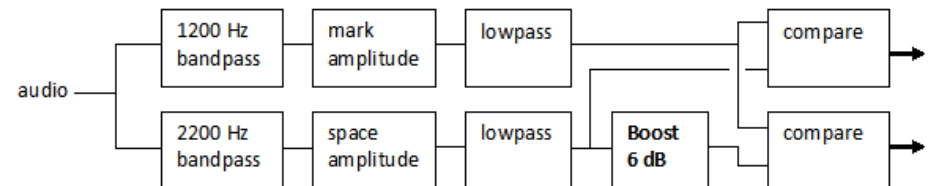
It doesn't take much more CPU time so why stop at two? I tried a little experiment with 9 different gains for the space tone at the same time.

Track 1 – Receiver with flat response.

Here we use the "E+" decoder which is now the default for Dire Wolf version 1.2. The "+" part means we use multiple gains and slicers rather than the AGC approach.

```
atest -P E+ 01_Track_1.wav

...


DECODED[49] Digipeater W6SCE-10 audio level = 52(15/22)
__|||____
 [0] KB6CYS>BEACON,W6SCE-10*:WEATHER STATION ON-LINE<0x0d>


DECODED[50] Digipeater N6EX-5 audio level = 58(18/26)
__|_____
 [0] KD6LAY>APW277,W6PVG-3,N6EX-
5*:=3438.88N/11815.40WyPHG5660/WinAPRS 2.7.7 -277-
<630><0x0d>



...


DECODED[1009] Digipeater W6SCE-10 audio level = 50(15/21)
|||||____
 [0] K6SYV-10>ANP391,W6SCE-
10*:!3444.00NS12000.40W#PHG7730/Wn,SCAn/FIGUEROA Mt./
A=003248<0x0d>


DECODED[1010] Digipeater N6EX-4 audio level = 51(16/26)
|||||____
 [0] N6XQY-12>GPSLJ,N6EX-4*:$GPRMC,021841.28,A,3346.1449,N
,11755.4088,W,00.0,000.0,231105,13.,E*71<0x0d>


DECODED[1011] Digipeater N6EX-4 audio level = 51(16/26)
||||||___
 [0] KN6DB-14>GPSLK,N6EX-4*:$GPRMC,021851,A,3348.8470,N,11
800.1685,W,000.0,274.0,231105,013.4,E*6D<0x0d><0x0a>


1011 packets decoded in 68 seconds.
```

You probably noticed something new: vertical bars and underscores after the audio levels. Each one of these character positions corresponds to a decoder with different gains for the space frequency.

| means a frame was received with a correct CRC.

_ means no frame was received.

As an example, _||_____ means the second and third decoders successfully received the frame.

When we add up the number of frames received, for each of the decoders, this is what we find:

Gain dB	Frames
-6.0	901
-3.8	978
-1.5	995
+0.8	985
+3.0	925
+5.3	653
+7.5	353
+9.8	109
+12.0	0
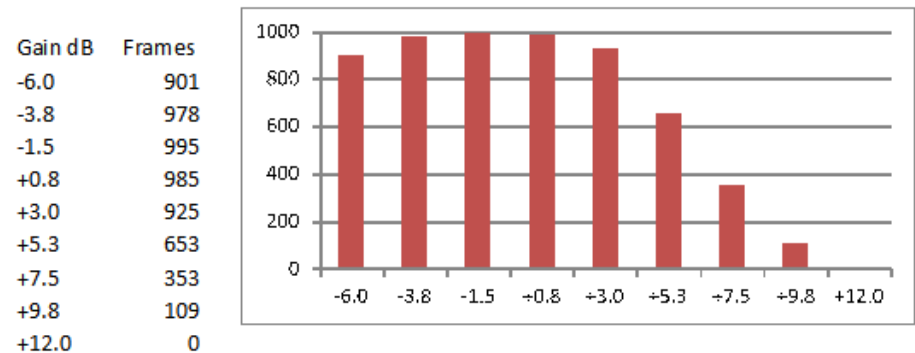
If we had to limit ourselves to a single comparator, the optimum gain would be around -1.5 dB producing 995 frames.

When we run all 9 at the same time and remove duplicates, we get 1011 frames.

Track 2 – Typical de-emphasis found with speaker output.

Now we try the same thing for Track 2.

```
atest -P E+ ../02_Track_2.wav


…


DECODED[49] Digipeater W6SCE-10 audio level = 26(2/1)
__|||||__
[0] KB6CYS>BEACON,W6SCE-10*:WEATHER STATION ON-LINE<0x0d>


DECODED[50] Digipeater N6EX-5 audio level = 7(3/1)
_____|__
[0] KD6LAY>APW277,W6PVG-3,N6EX-
5*:=3438.88N/11815.40WyPHG5660/WinAPRS 2.7.7 -277-
<630><0x0d>

…


DECODED[1002] Digipeater W6SCE-10 audio level = 19(2/1)
__|||||||
[0] K6SYV-10>ANP391,W6SCE-
10*:!3444.00NS12000.40W#PHG7730/Wn,SCAn/FIGUEROA Mt./
A=003248<0x0d>


DECODED[1003] Digipeater N6EX-4 audio level = 16(3/1)
__||||||_
[0] N6XQY-12>GPSLJ,N6EX-4*:$GPRMC,021841.28,A,3346.1449,N
,11755.4088,W,00.0,000.0,231105,13.,E*71<0x0d>


DECODED[1004] Digipeater N6EX-4 audio level = 16(2/1)
__|||||||
[0] KN6DB-14>GPSLK,N6EX-4*:$GPRMC,021851,A,3348.8470,N,11
800.1685,W,000.0,274.0,231105,013.4,E*6D<0x0d><0x0a>


1004 packets decoded in 69 seconds.
```
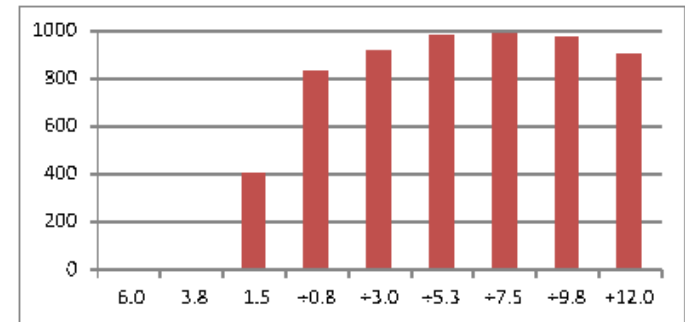
Gain dB	Frames
-6.0	0
-3.8	9
-1.5	407
+0.8	829
+3.0	918
+5.3	978
+7.5	983
+9.8	975
+12.0	901

Notice how the results are now skewed toward the right. We need to add more gain to compensate for the receiver de-emphasis of the higher frequencies. The same frame that was received by the second and third decoders, on Track 1, is now decoded by the seventh decoder.

If we had to limit ourselves to a single comparator, the optimum gain would be around +7.5 dB producing 983 frames.

When we run all 9 at the same time and remove duplicates, we get 1004 frames.

Summary of Results

What else can we do pull a few more frames out of the noise?

Dire Wolf has a unique feature where it will attempt to fix frames with a bad CRC. This has been available since February 2013 and is described in the User Guide section called "One Bad Apple Don't Spoil the Whole Bunch…" Use the "-F 1" option with "atest" to activate the feature.

The final results are:

Gain for balancing tones	Single bit fix-up	Command Line Options	Time, seconds	Track 1 Frames Decoded	Track 2 Frames Decoded
Automatic	no	-P E -F 0	63	993	988
9 different, remove duplicates	no	-P E+ -F 0	69	1011	1004
Automatic	yes	-P E -F 1	63	1012	1001
9 different, remove duplicates	yes	-P E+ -F 1	73	1021	1022

   A similar side-by-side real-time real-world comparison first appeared in the User Guide for Dire Wolf version 0.9. Let's try it again with improved software version 1.2.

## 1200 Baud hardware TNC comparison

   Here we compare 1200 baud decoder performance against two popular hardware based solutions. This was done before the new improved "E+" decoder.

   For this experiment we need:

- Antenna, outside on the roof.
- A cheap USB Audio Adapter (http://www.adafruit.com/product/1475 - You will be disappointed if you try using this with a Raspberry Pi.)
- Kantronics KPC-3 Plus
- Kenwood TM-D710A
- Serial communication cable for D710A

   (http://www.amazon.com/gp/product/B000068OER is a lower cost alternative to the official Kenwood PG-5G) – connect to COM port on control panel.

- Audio Y cables, RS232-cables.
- PC running Ubuntu Linux. Connect up everything as shown below.
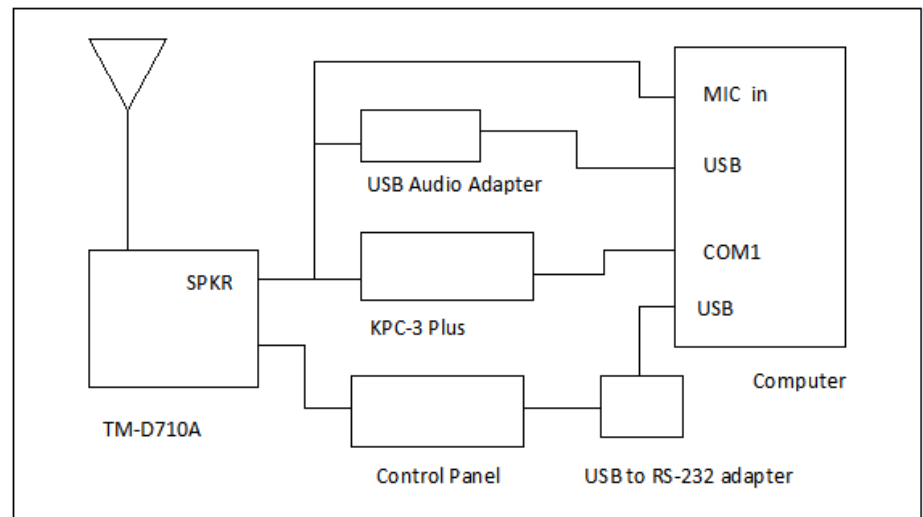
Prepare KPC-3 Plus

   Using some sort of terminal emulator application, such as minicom, connect to /dev/ttyS0. Disable any digipeater settings or beaconing (DIGIPEAT, UITRACE, UIDIGI, UIFLOOD, BEACON, BLT) so it is not distracted by trying to transmit. Beacons also show up like monitored transmissions. Enable monitoring:

```
MONITOR ON
```

You should see received packets being displayed. Exit from the terminal application.

Prepare D710A

Use the TNC button on the control panel to select "PACKET12" (not APRS) mode. Enable the COM port with menu 604.

Using some sort of terminal emulator application, connect to /dev/ttyUSB0. Disable any digipeater settings or beaconing so it is not distracted by trying to transmit. Enable monitoring:

```
MONITOR ON
```

You should see received packets being displayed. Exit from the terminal application.

Prepare Dire Wolf

Be sure to use version 1.2 or later for best performance. In this test we are using Linux so that device name syntax is shown.

Two different configuration files were prepared. The first (direwolf.conf0) will use the default audio input on the motherboard.

```
CHANNEL 0
MODEM 1200 1200 2200 C+
FIX_BITS 0
```

Note that attempted bad bit fix-up is disabled so we count only error-free frames. This provides a fair apples-to-apples comparison against the other systems without this feature.

Prepare a second configuration file (direwolf.conf1) like this.

```
ADEVICE   plughw:2,0
CHANNEL 0
```

```
MODEM 1200 1200 2200 C+
AGWPORT 8010
KISSPORT 8011
FIX_BITS 1
```

This provides the more typical usage with the default FIX_BITS value. A $5 external USB Audio Adapter is being used to dispel the rumor that you need an expensive sound card for good results.

Start up two different Dire Wolf instances, with different configuration files, in different windows.

```
direwolf -c direwolf.conf0
direwolf -c direwolf.conf1
```

Compare them.

Run the "aclients" test fixture with command line arguments like this

```
aclients /dev/ttyS0=KPC3+ /dev/ttyUSB0=D710A
8000=DireWolf-0 8010=DireWolf-1
```

Each command line argument is a serial port name or a TCP port number. Notice how we use two different port numbers for the two instances of Dire Wolf. The part after "=" is just a comment to label the results.

Packets are collected from 4 different sources and printed side-by-side in columns for each TNC. A gap means that TNC did not decode the frame that others did.

It starts off looking like this with the first couple packets being received by everybody.

```
john@hamshack:~$ aclients  /dev/ttyS0=KPC3+  /dev/ttyUSB0=D710A  8000=DireWolf-0 8010=DireWolf-1
Client 3 now connected to DireWolf-1 on localhost (127.0.0.1), port 8010
Client 2 now connected to DireWolf-0 on localhost (127.0.0.1), port 8000
Client 0 now connected to KPC3+ on /dev/ttyS0
Client 1 now connected to D710A on /dev/ttyUSB0
W1OEM-4>ID,EKONCT,W1MRA*,WI    W1OEM-4>ID,EKONCT,W1MRA*,WI    W1OEM-4>ID,EKONCT,W1MRA*,WI    W1OEM-4>ID,EKONCT,W1MRA*,WI
K1SEM>APWW10,KB1JDX-15,W1MR     K1SEM>APWW10,KB1JDX-15,W1MR     K1SEM>APWW10,KB1JDX-15,W1MR     K1SEM>APWW10,KB1JDX-15,W1MR
                                                              N1NCI-3>APN383:!4302.00NN07    N1NCI-3>APN383:!4302.00NN07
AB1OC-10>DX,RFONLY: <<UI>>:                                   AB1OC-10>DX,RFONLY:DX de  A    AB1OC-10>DX,RFONLY:DX de  A
N3LEE-7>T2TS4Y,WIDE1-1*,WID     N3LEE-7>T2TS4Y,WIDE1-1*,WID     N3LEE-7>T2TS4Y,WIDE1-1*,WID     N3LEE-7>T2TS4Y,WIDE1-1*,WID
N3LEE-7>T2TS4Y,WIDE1-1,AB1O     N3LEE-7>T2TS4Y,WIDE1-1,AB1O     N3LEE-7>T2TS4Y,WIDE1-1,AB1O     N3LEE-7>T2TS4Y,WIDE1-1,AB1O
KE5KTU-9>TR2P3Y,W1CLA-1,WID     KE5KTU-9>TR2P3Y,W1CLA-1,WID     KE5KTU-9>TR2P3Y,W1CLA-1,WID     KE5KTU-9>TR2P3Y,W1CLA-1,WID
KE5KTU-9>TR2P3Y,W1MHL,W1MRA     KE5KTU-9>TR2P3Y,W1MHL,W1MRA     KE5KTU-9>TR2P3Y,W1MHL,W1MRA     KE5KTU-9>TR2P3Y,W1MHL,W1MRA
                                                                                             KE5KTU-9>TR2P3Y,W1MHL,W1MRA
N1LMA-8>APNX01,EKONCT,W1MRA     N1LMA-8>APNX01,EKONCT,W1MRA     N1LMA-8>APNX01,EKONCT,W1MRA     N1LMA-8>APNX01,EKONCT,W1MRA
N1YG-1>T1SY9P,W2DAN-15,W1MR                                    N1YG-1>T1SY9P,W2DAN-15,W1MR     N1YG-1>T1SY9P,W2DAN-15,W1MR
WM1X>APU25N,WIDE2-1: <<UI>>     WM1X>APU25N,WIDE2-1 <UI C>:    WM1X>APU25N,WIDE2-1:@310423    WM1X>APU25N,WIDE2-1:@310423
                                                              WM1X>APU25N,AB1OC-10,WIDE2*    WM1X>APU25N,AB1OC-10,WIDE2*
```

… The totals for each are displayed once every 30 minutes. …

```
K1SEM>APWW10,N1NCI-3,WIDE1,                                    K1SEM>APWW10,N1NCI-3,WIDE1,     K1SEM>APWW10,N1NCI-3,WIDE1,
N1OMJ>APWW10,W1MRA*,WIDE2-1     N1OMJ>APWW10,W1MRA*,WIDE2-1     N1OMJ>APWW10,W1MRA*,WIDE2-1     N1OMJ>APWW10,W1MRA*,WIDE2-1
N1OMJ>APWW10,W1MRA,N8VIM,WI     N1OMJ>APWW10,W1MRA,N8VIM,WI     N1OMJ>APWW10,W1MRA,N8VIM,WI     N1OMJ>APWW10,W1MRA,N8VIM,WI
                               N1OMJ>APWW10,W1MRA,W1JMC* <     N1OMJ>APWW10,W1MRA,W1JMC*:@    N1OMJ>APWW10,W1MRA,W1JMC*:@
N1OMJ>APWW10,W1MRA,AB1OC-10                                    N1OMJ>APWW10,W1MRA,AB1OC-10     N1OMJ>APWW10,W1MRA,AB1OC-10
N1ESA>TQRX9P,EKONCT,W1MRA*,     N1ESA>TQRX9P,EKONCT,W1MRA*,    N1ESA>TQRX9P,EKONCT,W1MRA*,    N1ESA>TQRX9P,EKONCT,W1MRA*,

Totals after 30 minutes, KPC3+ 208, D710A 197, DireWolf-0 297, DireWolf-1 318

                               MCU-4>T1RS0S,EKONCT,W1MRA,W     MCU-4>T1RS0S,EKONCT,W1MRA,W     MCU-4>T1RS0S,EKONCT,W1MRA,W
                                                              N3LEE-7>T2TS5Q,AB1OC-10,WID     N3LEE-7>T2TS5Q,AB1OC-10,WID
N3LEE-7>T2TS5Q,AB1OC-10,WID     N3LEE-7>T2TS5Q,AB1OC-10,WID     N3LEE-7>T2TS5Q,AB1OC-10,WID     N3LEE-7>T2TS5Q,AB1OC-10,WID
K1SEM>APWW10,KB1JDX-15,W1MR     K1SEM>APWW10,KB1JDX-15,W1MR     K1SEM>APWW10,KB1JDX-15,W1MR     K1SEM>APWW10,KB1JDX-15,W1MR
                                                              W1AST>TRPR4S,KB1AEV-15,N1NC     W1AST>TRPR4S,KB1AEV-15,N1NC
AB1OC-10>DX,RFONLY: <<UI>>:     AB1OC-10>DX,RFONLY <UI R>:D    AB1OC-10>DX,RFONLY:DX de  A    AB1OC-10>DX,RFONLY:DX de  A
W1MV-1>BEACON,W1MRA*,MA2-1:     W1MV-1>BEACON,W1MRA*,MA2-1     W1MV-1>BEACON,W1MRA*,MA2-1:     W1MV-1>BEACON,W1MRA*,MA2-1:
```

… After running several hours and we find these totals: …

```
AB1OC-10>APWW10,N8VIM,WIDE1    AB1OC-10>APWW10,N8VIM,WIDE1    AB1OC-10>APWW10,N8VIM,WIDE1    AB1OC-10>APWW10,N8VIM,WIDE1
W1BRI>APW261,W1MRA*,WIDE2-1     W1BRI>APW261,W1MRA*,WIDE2-1    W1BRI>APW261,W1MRA*,WIDE2-1    W1BRI>APW261,W1MRA*,WIDE2-1
N1LMA>APU25N,EKONCT,W1MRA*,                                    N1LMA>APU25N,EKONCT,W1MRA*,    N1LMA>APU25N,EKONCT,W1MRA*,
N1LCY>APU25N,W1MRA*,WIDE2-1     N1LCY>APU25N,W1MRA*,WIDE2-1    N1LCY>APU25N,W1MRA*,WIDE2-1    N1LCY>APU25N,W1MRA*,WIDE2-1
N1ESA>TQRX9Q,EKONCT,W1MRA*,     N1ESA>TQRX9Q,EKONCT,W1MRA*,    N1ESA>TQRX9Q,EKONCT,W1MRA*,    N1ESA>TQRX9Q,EKONCT,W1MRA*,
AB1OC-10>APWW10,WIDE1-1*,WI     AB1OC-10>APWW10,WIDE1-1*,WI    AB1OC-10>APWW10,WIDE1-1*,WI    AB1OC-10>APWW10,WIDE1-1*,WI
AB1OC-10>APWW10,WIDE1-1,N8V     AB1OC-10>APWW10,WIDE1-1,N8V    AB1OC-10>APWW10,WIDE1-1,N8V    AB1OC-10>APWW10,WIDE1-1,N8V
                                                                                             AB1OC-10>APWW10,WIDE1-1,AB1
N1OMJ>APWW10,W1MRA*,WIDE2-1     N1OMJ>APWW10,W1MRA*,WIDE2-1    N1OMJ>APWW10,W1MRA*,WIDE2-1    N1OMJ>APWW10,W1MRA*,WIDE2-1
N1OMJ>APWW10,WA1PLE-15,WIDE     N1OMJ>APWW10,WA1PLE-15,WIDE    N1OMJ>APWW10,WA1PLE-15,WIDE    N1OMJ>APWW10,WA1PLE-15,WIDE
N1ZZN>APAGW,W1MRA*,WIDE2: <     N1ZZN>APAGW,W1MRA*,WIDE2 <U    N1ZZN>APAGW,W1MRA*,WIDE2:@3    N1ZZN>APAGW,W1MRA*,WIDE2:@3
K1SEM>APWW10,N1NCI-3,WIDE1,     K1SEM>APWW10,N1NCI-3,WIDE1,    K1SEM>APWW10,N1NCI-3,WIDE1,    K1SEM>APWW10,N1NCI-3,WIDE1,
K1SEM>APWW10,N1NCI-3,WIDE1,     K1SEM>APWW10,N1NCI-3,WIDE1,    K1SEM>APWW10,N1NCI-3,WIDE1,    K1SEM>APWW10,N1NCI-3,WIDE1,
N3LEE-2>GPS: <UI>:!4243.50N     N3LEE-2>GPS <UI>:!4243.50NS    N3LEE-2>GPS:!4243.50NS07144    N3LEE-2>GPS:!4243.50NS07144

Totals after 540 minutes, KPC3+ 4255, D710A 4076, DireWolf-0 5667, DireWolf-1 6088
```

Results

If we give the highest number a score of 100% and scale the others proportionally, the scores are:

- 100%   Dire Wolf, single bit fix up
- 93%   Dire Wolf, error-free frames only
- 70%   Kantronics KPC-3 Plus
- 67%   Kenwood TM-D710A

The exact proportions will vary depending on what stations you happen to hear.

There should be enough detail here for others to repeat this experiment and verify results.

###

Amateur Radio Lectures in India

By Miroslav "Misko" Skoric, YT7MPB

Since my previous conference journey to India in September 2013, I could not wait more for the next visit to that fascinating country, so I did it again one year after. As usual, my travels are connected to conference activities, however to make this self-funded voyage more cost-effective, I decided to start with a 2-day session on the Amateur Radio ICT, software and computer networks in education, kindly organized with Surdar Vallabhai National Institute of Technology in Surat. NIT Surat is one of the most prestigious institutions of its kind in the state of Gujarat. I was lucky enough to have technical assistance and presenting support by Huzefa Merchant, VU2HIT, a Mumbai-based Indian ham who happened to come to Surat for his family visit, (Figure 1).

I was really privileged to share a part of my lecture with Huzefa because he was more familiar with Indian radio regulations and local practices. Thankfully to Prof. Mrs. Upena Dalal (Figure 2, front row, the third on the right in red dress), several female students were also in the audience. In opposite to many western countries, it seems that Asian schooling in technology does not suffer from the known phenomenon of decreasing interest for ICT education in girls and women.

Figure 1

Figure 2

Besides technical aspects of my visit, I had a chance to observe busy streets of Surat – occupied by local citizens who celebrated national holiday, and to taste delicious Indian food in the NIT's guesthouse. In addition, it was interesting to learn about nice custom where several families in the neighborhood of Prof. Dalal regularly gather together to cook a kind of doughnuts on an open fire oven.

The main event of my journey started a couple of days later. At first, I had to take some long flights to reach Hyderabad area. Thankfully to the organizational support of Mr. Mohan Ram, VU2MYH, (Figure 3, first on the left), director of National Institute of Amateur Radio (NIAR), the one of the most influencing ham radio groups in the country, I conducted a tutorial session with 11th International Conference on Wireless and Optical Communications Networks (WOCN 2015), organized at 'KL University' in Vijayawada. Being a newly-appointed capital of Andhra Pradesh state, and despite visible investments in modern student housing at KLU, Vijayawada city is yet to be recognized by foreign researchers. To help in this, local newspapers paid full attention to our Amateur Radio presentation and provided full media coverage (Figure 3).

Figure 3

Although being located some half an hour from the inner city area, KLU is full of young and seasoned technologists, and is surrounded by a plenty of greenery and has an excellent position for establishing an Amateur Radio relay station (Figure 4).

Figure 4

As expected, the organizational committee had ensured a colorful conference banquet with local folklore performers taking role in the evening program, and a bunch of thrilled guests made queues at dinner & ice-cream lines.

After returning back to Hyderabad – recently appointed as capital of Telangana state, NIAR organized two more lectures. The first was held at Gokaraju Rangaraju Institute of Engineering and Technology (known as GRIET, Figure 5), where the practical part of the session was performed by Mr. Jose Jacob, VU2JOS, deputy director of NIAR, (Figure 6, on the right).

Day ended by visiting one of the locally favored coffee-tea-pastry shops in downtown Hyderabad. The following day was also busy with the session at Department of Electronics and Communication Engineering, at Vardhaman College of Engineering. Prof. Zafar Ali Khan of Indian Institute of Technology Hyderabad, (Figure 7, sitting second from the right) gave some inaugural words. Then Mohan VU2MYH and I took the rest of the talk.

The room was fully occupied by students and staff (Figure 8). Unfortunately, that part of India severely suffers from electricity blackouts, what led our program being interrupted for several

Figure 5

Figure 6

Figure 7

Figure 8

times. To compensate, we prolonged the session for about one hour, and had

  to cancel a planned visit to IIT Hyderabad. A couple of days later, another two-day workshop was scheduled with Department of Telecommunication Engineering at BMS College of Engineering in Bangalore, thankfully to joint efforts of Dr. Srinivas Talabattula, chair of IEEE ComSoc Bangalore Chapter, BMSCE officials, and Mr. Munir Mohammed, program specialist at IEEE India office in Bangalore (Figure 9, left).

  The next stop of my journey was Chennai (formerly Madras). The main event was a lecture at SRM University, located approximately 45 minutes by car from the urban city area. It was Sunday when I came there, so a group of local students kindly offered me the train ride to a historical site.

  Before I left Chennai, I wanted to learn some more about that part of India. Escorted by a local 'ham' on a motorbike, I visited Gallery of Contemporary Art – a part of large museum complex, and instead of a 'Thank You' note to the friendly hams I gave another ham-digital-related lecture to the members of a local Amateur Radio club, (Figure 10).

Figure 9

Figure 10

The final portion of my journey included three educational institutions in Gwalior city, placed in the middle of Madhya Pradesh. Thankfully to Prof. Srivastava (Figure 11), and Jayant S. Bhide, VU2JAU, the local Amateur Radio leader (Figure 12) and his friends, the first activity was conducted with students and staff of Indian Institute of Information Technology and Management (IIITM Gwalior, Figure 13).

The Institute is one of the most remarkable of its kind. I was accommodated in their VIP

guest house, and Ashok -the house master was the great chef.

The next session was performed in front of the young audience at Gwalior Glory High School, (Figure 14). Thankfully to hospitality of the school's Principal, we ended our visit by a tea-talk.

Figure 11

Figure 12

Figure 13

Figure 14

The afternoon's session was done with Department of Electronics & Communication Engineering at IPS College of Technology & Management (Figures 15-17). Once again, it was encouraging to see many female students in the room. The future seems to be bright.

To finalize this report, I got a feeling that Indian education is eager for novelties and challenges of many kinds. They are not reluctant to ask for more. It is obvious that there will be more Amateur Radio tutorials and workshop sessions in years to come. One of the plans includes establishing an 'international conference on the Amateur Radio software and computer networks in education', as well as various events in form of 'summer schools'. In that direction, many people mentioned in this report (and some others who were not listed here) addressed open calls for prospective participants in such events. Should you want to collaborate please do not hesitate to get in touch.

Email: skoric@uns.ac.rs

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Figure 15

Figure 16

Figure 17

Write Here!

Your *PSR* editor is looking for a few good writers, particularly ham radio operators working on the digital side of our hobby, who would like to write about their activities and have them published here in *PSR*.

You don't have to be Hiram Percy Maxim to contribute to *PSR* and you don't have to use *Microsoft Word* to compose your thoughts.

The *PSR* editorial staff can handle just about any text and graphic format, so don't be afraid to submit whatever you have to wa1lou@tapr.org. The deadline for the next issue of *PSR* is August 1, so write early and write often.

If *PSR* publishes your contribution, you will receive an extension to your TAPR membership or if you are not a member, you will receive a TAPR membership.

###

On the Net

By Mark Thompson, WB9QZB

Facebook

As you may know, TAPR has a Facebook page, www.facebook.com/TAPRDigitalHam.

However, I also created a TAPR Facebook Group, www.facebook.com/groups/TAPRDigital/.

If you have a Facebook account, "Like" the TAPR Facebook page and join the TAPR Facebook Group.

If you join the group click on the Events link and indicate you're Going to the events.

On Twitter, Too

Access the TAPR Twitter account at

www.twitter.com/taprdigital.

Also on YouTube

TAPR now has its own channel on YouTube: the TAPR Digital Videos Channel: www.youtube.com/user/TAPRDigitalVideo.

At this time, there are a slew of videos on our channel including many from the TAPR-ARRL Digital Communications Conference (DCC) that you may view at no cost, so have at it!

###

PSR

Submission Guidelines

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

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