



PCARA Update



Volume 22, Issue 9 Peekskill/Cortlandt Amateur Radio Association Inc. September 2021

Goodbye summer, hello fall

I'm glad to report we had an uneventful summer from a PCARA perspective. Sometimes nothing is a good thing, considering the world we find ourselves in. The quiet has been punctuated by events such as PCARA Breakfasts, PCARA V.E. Test Sessions and the occasional Hamfest.

The **Sussex County Amateur Radio Club Hamfest** was held on July 18, 2021 in Augusta, NJ. There was quite a crowd with many vendors and tailgaters, some of our members among the latter. A group of us attended a presentation by ARRL Hudson Division Director Ria Jairam N2RJ on current events taking place with the League with respect to ARRL Emcomm initiatives. An excellent talk.



Mike KD2PYS and Mike N2EAB had an outdoor table at the Sussex County ARC Hamfest in Augusta NJ on July 18.

July saw a **PCARA Breakfast** on July 24, 2021 at Downing Park under the pavilion, with another excellent turnout! Thanks to ALL who attended. In August we held a **PCARA Breakfast** (11 members) on Saturday August 21, 2021 in Downing Park in Yorktown Heights, followed by a **PCARA V.E. Test Session** at the John C. Hart Memorial Library in Shrub Oak, NY. At the Test Session Rob KD2WCL upgraded to Extra from General and is now AD2CT. Since November 2020, we've seen eleven brand new hams and eight upgrades as a result of the test sessions. Absolutely AMAZING. Let's keep up the pace!



Members enjoyed PCARA breakfast on Saturday July 24 at Downing Park pavilion in Yorktown, followed by a V.E. Test Session in Shrub Oak.

Looking forward, we have a few things going on. On Saturday September 11, 2021 at 9:00 a.m. there will be a **PCARA Membership Meeting** at the John C. Hart Memorial Library in Shrub Oak, NY. The meeting will be followed by a **PCARA V.E. Test Session** at 11:00 a.m. Please consider joining us and continue to spread the word about the test sessions. Our next **PCARA Breakfast** is scheduled for Saturday September 25, 2021 at 9:00 a.m. at Downing Park in Yorktown Heights, NY. Bring your appetites!

PCARA has taken a **club table** — originally booked for the Spring 2020 event — at the upcoming Orange County Amateur Radio Club Hamfest in Middletown, NY on Sunday September 12, 2021. Members are invited to bring along any items they may wish to sell. Doors open at 8:00 a.m., with setup beginning at 7:00 a.m.

Returning this year on Sun- Continued on page 2 ⇨

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day October 17, 2021 will be the Harry Chapin Memorial **Run/Walk Against Hunger** at the Croton-Harmon High School in Croton-on-Hudson, NY. This is a most worthwhile cause so consider coming out to help support our communities. More details to follow as we get closer to the date.

I look forward to seeing each of you at the PCARA Meetings, Test Sessions and Breakfasts. Please stay safe.

- 73 de Greg, KB2CQE

PCARA Board

President:

Greg Appleyard, KB2CQE; kb2cqce 'at' arrl.net

Vice President:

Bob Tarsio, N2CBH; bob 'at' broadcast-devices.com

Secretary:

Lou Cassetta, KD2ITZ; radiocassetta 'at' gmail.com

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David Fredsall KD2EVI; joanndavidss88 'at' verizon.net

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Net night

Peekskill/Cortlandt Amateur Radio Association holds a roundtable net on Tuesday evenings at 8:00 p.m. and a directed 'Old Goats' net on Thursday evenings at 8:00 p.m. Both events take place on the 146.67 MHz W2NYW repeater, offset -0.600, PL 156.7 Hz.

Join the roundtable to find out what members have been doing or join the Old Goats with net control Karl N2KZ for news and neighborly information.

V.E. Test Sessions

Although PCARA has been on "Summer Break" during July and August, several activities continued throughout this period including Volunteer Examiner Test Sessions.

One detail left out of the report on PCARA's Field Day in the July 2021 issue was a missing call sign. Frank from Port Chester, NY passed his Technician exam at the Field Day test session held on Sunday June 27 and had the call sign KD2WPO assigned by the FCC on July 2, 2021.

During PCARA's next V.E. Test Session, held on Saturday July 24 in the grounds of John C. Hart Library, Frank KD2WPO returned and was successful in upgrading from Technician to General. He also became a member of PCARA. Three more candidates were successful in passing the Technician examination and were granted new call signs by the FCC on July 29th. Con-



The V.E. Test Session on Saturday July 24 took place in the shady picnic table area at John C. Hart Library.

gratulations to David KD2WST of New York, NY; to James KD2WSU of Mahopac, NY and to Peter KD2WSV of Katonah, NY. James and Peter both joined PCARA as well.

Thanks to the Volunteer Examiners who took part in the July session — Team Liaison Mike W2IG, Lou KD2ITZ, Stan WA2NRV, Verle, W2VJ, Joe W2BCC and NM9J.

The second V.E. Test Session of Summer Break took place on Saturday August 21st, once again in the grounds of

John C. Hart Library. There was just one candidate — PCARA member Rob KD2WCL, who upgraded to Extra, having achieved Technician and General at the March and April sessions earlier this year.



Rob KD2WCL (right) receives his Extra-Class CSCE from Lou KD2ITZ during the V.E. Test Session on August 21. [W2IG pic]

FCC issued an upgraded **Amateur Extra** license to Rob on August 27, 2021 along with a new systematic call sign: **AD2CT**. Congratulations Rob. Commence Traffic!

Thanks again to the Volunteer Examiners who took part in the August 21 session — to Mike W2IG, Lou KD2ITZ, Stan WA2NRV, Larry AC2QH and NM9J.

The next V.E. Test Session is scheduled for Saturday September 11 starting at 11:00 a.m. at the John C. Hart Library in Shrub Oak, NY. Candidates should contact Mike W2IG beforehand using the e-mail address: w2igg'at'yahoo.com. The V.E. Test Session will follow PCARA's monthly meeting which begins 9:00 a.m. at the Library.

- NM9J

Adventures in DXing

- N2KZ

More Microwave

How can you abandon an old friend? My ailing mid-2012 MacBook Pro required geriatric rehabilitation. Its Wi-Fi capability went nearly deaf. It felt like a 30 dB pad had been switched on, nearly disabling the receiver. I could only make a connection if I was very, very close to an access point — or — if I used a CAT 5 cable to wire me in directly.



I toughed it out for months and adapted my habits to my new electronic handicap. My Wi-Fi reception slowly and progressively became worse. My first act was to bring it to my friendly local Apple repair center. After a good look and serious diagnostics, they declared that the Wi-Fi card was OK. The antenna built into the screen assembly was OK. My ailment was due to a failure in the motherboard.

What do you do with a nearly decade-old computer with a bad motherboard? ‘Goodbye’ was not an option! I didn’t want to give it up! The peripherals and features of my old Mac are no longer offered in modern laptops — it has a slick built-in CD-DVD drive (remember those?), a SD card slot, audio input and output jacks and Thunderbolt, Firewire and a gigabit Ethernet port. No adapters or adapter dongles necessary! It has a 500 GB SSD drive so it is still quite speedy. It is heavy and bulky but very useful and agile. We have logged many, many miles together. This can’t be the end!

Blinking back the tears, I priced out a new full-featured MacBook Pro which resulted in an estimate of over \$7,000. (I guess you can see that I like full-featured computers!) There had to be a more affordable solution.

To keep my old Mac going, the repair folks suggested a wireless-to-USB adapter as an inexpensive fix. My research that followed was exhaustive! I didn’t want to just replace its Wi-Fi capability. I wanted more. I wanted the best.

I finally decided on a **TP Link Archer T4U Plus** featuring a design ready for DX-ing! The main unit was almost as large as a stack of playing cards with dual high-gain steerable antennas and a long USB cord. Each antenna stick was actually a stacked array. Remember



Archer T4U Plus dual antenna high-gain wireless USB adapter.

that the wavelengths at 2.4 GHz and 5 GHz are quite tiny! I ordered one with high hopes for success.

Upon receipt, I loaded the latest Mac software driver and plugged it in. TP Link claimed a nominal 5 dB gain and their estimate seemed conservative. The application pull-down showed me more neighborhood Wi-Fi broadcasters than I had ever seen by far. The directionality was quite obvious, too. Great!

There was one small drawback: I had no Internet connectivity. After consulting with TP Link support, I had to pack the unit up for a return. The Archer T4U Plus only supports older versions of Mac OS. I am running Catalina 10.15.7 and none of their wireless to USB adapters worked with this version or its descendant known as Big Sur. The Archer T4U Plus is quite capable of use with Windows 7/8/8.1 and 10. Microsoft users should give this adapter a test drive. You will be amazed! Mac owners have to look further... and I did!

I went back to the Internet and searched carefully for a product precisely compatible with macOS Catalina 10.15.7. It wasn’t easy. Netgear had no solutions. I finally found a tiny miniature adapter by Taiwanese manufacturer Edimax — the model EW-7822ULC from their AC1200 series. Edimax wrote a driver specifically for Mac Catalina 10.15.7 and their support staff e-mailed me the driver so I could install it before I received the actual adapter. It worked like a charm and even more!

I noticed immediately that the speed of my Wi-Fi connections was now quite noticeably faster and the retention of marginal signals was instantly impressive and confident.



Edimax USB-Wi-Fi adapter plugged into MacBook Pro. [N2KZ pic.]

How could this tiny little module, about half the side of a normal USB connector, produce such marvelous results? It is so small, you will forget it is even there. I had to quench my curiosity!

These high-gain supersonic wireless to USB adapters were designed for lucrative large-volume sales to a desirable and enthusiastic audience: **gamers**. No matter how new your computer is or how well it is outfitted, chances are that you are lagging behind the top of the pack when it comes to connectivity speed and rock-solid reliable connections. If you need a competitive edge and the most powerful performance possible, wireless-to-USB adapters are a remarkable and cost-effective way to stay on top of your game. Even if you are an undemanding Wi-Fi user, you would certainly

enjoy the speed and reliability the very latest version USB adapter brings.

Using today's advanced Wi-Fi technologies and hardware, you can approach nearly a full gigabit per second of connectivity on 5 GHz and up to 500 Mbps on good old and reliable 2.4 GHz.



Edimax EW-7822ULC Wi-Fi/USB adapter allows selection of the 2.4 GHz or 5 GHz frequency band with top speeds of 300 Mbps and 867 Mbps respectively.

New USB Wi-Fi adapters also take advantage of other speed accelerators like the **MU/MIMO** (multiple-user/multiple-input, multiple-output) multiplexing scheme that will make your laptop fly away with speed. There's more: The tiny Edimax adapter includes a magical technology called **beamforming** that accurately slews your wi-fi signal towards the location of your router hub automatically. (How do they do that?)



The EW-7822ULC's beamforming enables the Wi-Fi signal to be targeted at the USB adapter for a stronger Wi-Fi connection when paired with any beamforming router.

There is a lot of magic inside this tiny adapter and I am thoroughly enjoying every minute! Problem solved!

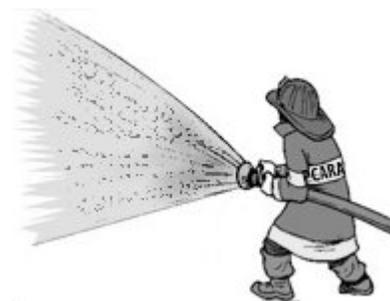
Experience = Knowledge

"Anyone who keeps learning stays young." – Henry Ford.

Wi-Fi microwave continues to fascinate me. The variables are many. Most Wi-Fi antenna sticks are actually stacked arrays combining several antenna elements that create narrow beamwidths to extend range. Teaming two stick antenna arrays not only creates a bi-directional transceiver pattern in the x-axis, it also narrows the beam along the y-axis. Let me explain...

Have you ever used a garden hose or pressure washer with an adjustable spray head? When you have

the sprayer all the way out, you get a wide-spread misty result in one direction very close to where you are standing. As you screw the sprayer in, the water gets ever more concentrated in a very directional beam. You are focusing all your energy in a specific direction to move the water as far as possible just where you want it.



This is exactly what you are doing when you combine active and passive antenna elements. The correct spacing between elements hopefully distributes transmission power to create a beam to satisfy your requirements. Physical placement of your system is a paramount factor! This is a literal example of 'getting focused'!

Here is a great example: I experimented with Wi-Fi antennas inside a large expansive two-story house. The home's main router hub was installed on top of a refrigerator at the service entry point on the first floor. The integrated Wi-Fi hub and router was a self-contained hardcover book-sized device providing few options for placement or antenna manipulation. The antenna array was etched into the printed circuit board inside the device housing. Predictably, reception to the other side of the house, especially to the second floor was very inadequate.

In an effort to improve things, I ran a wired CAT 5 connection to a previously retired 2.4 GHz Wi-Fi router hub donated by a family member. The installation was on a high shelf on the second floor. Two or three rooms on the second floor enjoyed improved Wi-Fi. How were things on the far side of the first floor? Well... not so much!

The two antennas of the newly added second floor hub created a narrow enough beam to almost ignore the first floor. A TV flat screen only 20 feet directly below received only a wisp of a signal from above. Tilting the hub 90 degrees was counterproductive. The Wi-Fi energy now directed towards the TV was now horizontally polarized. It was not a good solution! Most all Wi-Fi operations are vertically polarized. Orienting Wi-Fi antennas demands your creativity and lots and lots of experimentation. Preparation, thought and planning are essential ingredients for success.

In a perfect world, your main Wi-Fi access point should be located in the center of activity and use around your home and office. Appropriate height is important! Unlike amateur radio VHF and UHF operations, Wi-Fi access points should be roughly at the height of the users of the system to maximize signal exchange. Remember the garden hose analogy I mentioned? It is much more effective to shoot straight at

your target instead of up or down. Keep reminding yourself that microwaves behave much like a flashlight beam. You want to see the light!

After some trial and error to find a good 'sweet spot' for your primary Wi-Fi access device, you may need to build out your installation using remote filler repeaters or new *mesh* designs that will hopefully provide more Wi-Fi service to your entire home with more reliability.

The simplest approach is to try self-contained single-unit Wi-Fi range extenders. They receive the signals from your main access point and give them a little boost similar to how amateur radio repeaters work. Extenders are relatively cheap and most are self-contained units that plug into any available wall outlet.

You need to consider a couple of things before purchase and trial: Most household A/C power outlets are positioned low down the household wall. This may not be an ideal location for Wi-Fi re-transmission.

Most extenders use two little antennas. This produces a beam back and forth between the goal posts, so to speak. Half of your signals will be slamming against the wall it is mounted on possibly creating many interesting bounces of signal producing unpredictable and uneven coverage.

Also, extenders don't swivel. You are stuck with only one direction of transmission when you plug an extender into the wall. If your target is around the corner or 90 degrees away from your antenna pair it may not be very effective at all. The hand-off between the main unit and the extender will slow the speed of your Internet connection dramatically. Extenders may help you in a pinch... or maybe not!



TP-Link RE305 Wi-Fi Range Extender plugs into an AC outlet.

Today's Wi-Fi is a Mesh

There has to be a better way...and now there is! The latest design in household Wi-Fi design uses a technology called a *mesh*. Most *mesh* design offerings include three units: A main point-of-entry access router /hub and two extender units — all designed for desk-top positioning.

Mesh technology is far advanced from yesterday's Wi-Fi. You really need to up your geek to follow and understand all the nuances now being offered. Many *mesh* systems incorporate a new third Wi-Fi band at 6 GHz allowing even faster speeds than before. The hand-off between main units and remotes becomes much more efficient and Wi-Fi speeds accelerate proportionately. You can often purchase more remote units according to your needs.

Other features include complex virus and security control systems, 3.6 Gbps Wi-Fi speed and enough throughput to handle 40 or more devices simultaneously.



TP-Link Mesh WiFi units deliver seamless coverage and connect a whole home — in contrast with range extenders that add coverage but create separate networks.

List prices for these state-of-the-art systems can reach to \$1,000 or more! Warning: Install one of these systems and you may never see your teenagers again! There is a lot to read about these advances and a lot to learn. Super-sonic Wi-Fi has a lot to offer but it certainly isn't free. If you want the very best... this is it! Choose wisely!

Final Thoughts

Let me leave you with some of the basics of Wi-Fi technology:

Transmission and reception of Wi-Fi is nearly always vertically polarized. Keep your antennas straight up and down! Position Wi-Fi devices at the same height and level as the targets they are trying to reach. Too high or too low will decrease your signal strength and throughput. Using a diagnostic signal application can aid you in positioning Wi-Fi devices... but don't be surprised if the signal levels shown vary with the slightest movements of your devices or anything nearby or yourself! Remember that Wi-Fi signals behave similarly to visual light. Always have your Wi-Fi devices in places where they are free and clear to radiate and receive. Walls, cabinetry, metal and even lead-laden windows can kill signals! Finally, be aware that modern Wi-Fi devices often use dynamic channel assignment to maximize their effectiveness. Don't be surprised if you thought you assigned a static frequency of channel 1 and it flipped to channel 6 or 11 by itself! With millions of active Wi-Fi devices out there with no frequency co-ordination at all, it really is the RF wild west! Remember CB channel 19? Just like that!

Until next month, 73s and dit dit from N2KZ — "The Old Goat."



IC-2730A installation

in 2015 Nissan Frontier – KD2EVI

I enjoy having a mobile radio in the vehicles that I drive. A BaoFeng HT sitting in the center console attached to a mag mount antenna on the roof soon proved to be not very satisfactory. A TYT TH-8600 powered by the cigarette lighter outlet and a more permanent mobile antenna was a big step up, but could be improved.

I recently replaced my TYT TH-8600 25/20 watt dual band mobile with a 50 watt Icom IC-2730A in my Nissan Frontier (for the time being my Subaru Forester will retain its TYT.) In addition to the theoretical benefit of more output power, the Icom has a larger and clearer display, a detachable head, and is overall easier to use. I am familiar with this radio, having another in my QTH, which I am very happy with. To take advantage of the detachable head unit, I followed Bob N2CBH's advice and purchased a flexible Lido mount



Diminutive TYT TH-8600 dual-band transceiver.



Icom IC-2730A dual-band transceiver for 144 and 440 MHz.

which secures to a seat bolt.

[See: <https://www.lidoradio.com/>]

Current concern

Since the Icom will draw 10 - 13 amps on full power, (the TYT is listed as 4 amps) it cannot be run at full power from an accessory power outlet. Contemporary vehicles use a current sensor to tell the alternator



Cabin fuse panel.

how much power to produce. It is therefore important that the radio be wired in such a way that it does not bypass the vehicle's current sensor. A few months back I attempted to run the power from a fuse block located near the glove box. I succeeded in blowing a fuse and losing my interior lights due to the Power Control Module being disturbed. I replaced the fuse and reset the module by disconnecting a battery terminal. A better solution was needed.

Under the hood

After carefully studying the wiring under the hood and reading others' experiences on the Internet, I ran 10 gauge wire from the battery into the cab of the truck.

I attached the positive wire outboard of the wiring and fuses on the positive battery terminal (see pic)...



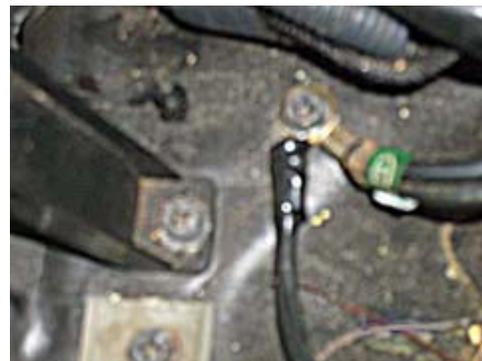
10 gauge (red) wire is secured to the fusible link assembly on the Nissan's battery positive terminal. [KD2EVI pic.]

...and the negative cable underneath, where the under-hood fuses and relays ground to the frame.

The 10 gauge wire was zip-tied to the existing wiring harness and — since

my vehicle has an automatic transmission — brought into the cab through the unused clutch cable grommet.

The Icom IC-2730A comes with a generous length of fused power cord, which I cut and soldered to reduce its length and provide a secure connection to the 10 gauge wires.



Black negative wire is connected to ground terminal on the vehicle frame. [KD2EVI pic.]



10 gauge red/black cable fastened to the wire loom that passes from engine compartment through the firewall. [KD2EVI pic.]

Inside the cab

The Lido mount was attached to the front left passenger seat bolt, allowing easy reach to the control head, a clear view of the display, while remaining clear of the console-mounted shift lever. The control head can simply be lifted off the mount and



Icom IC-2730 control head installed on a 'Lido Seat Bolt Mount' inside Frontier cab.

placed in the glove box if you wish to make the installation less conspicuous while parked. It does move a slight bit while driving, but the motion is not excessive and the flexibility of the mount, clear view of the display and access to the radio controls is a good trade-off in my opinion. The TYT was difficult, if not impossible to read while driving with its smaller, fixed display.

The body of the radio was placed on a shelf on the front console. I had the TYT in that position, the Icom is larger, even without the control head, but just fits. I screwed the mount that Icom supplied to the plastic shelf to support the radio. I had tried 3M™ double sided tape to hold the TYT, but it broke free in short order. Since I own the truck, I am not concerned with returning it at the end of a lease with miscellaneous holes. The body of the IC-2730 is now secure and has enough space around it for air flow to keep the radio cool during use.



Body of the IC-2730 transceiver is installed separately from the control head on an Icom MBF-4 mobile mounting bracket, screwed to the shelf on the center-front console.

I could also have mounted the radio underneath the dash on the driver's side. There is plenty of room under the dash in the Frontier if you desire a hidden location. The radio is quite audible in its present location.

To program the radio I used RT Systems software. I had used this software to program the IC-2730 in my QTH, and it is worth the \$60 price. You can use alpha characters to name the repeater or frequency and use the different memory banks in the 2730, as well as setting the output power.



KD2EVI's pickup truck with IC-2730A transceiver and Comet SBB5 NMO roof-mounted antenna, pictured at Downing Park.

Overall, I have a better quality, more powerful radio which is safer and easier to use while driving now that I have completed the installation.

- 73 de David, KD2EVI

See also: "Dual-band NMO-mount antenna installation - KD2EVI" in *PCARA Update*, Sept 2020, pp 8-9.

For a review of the IC-2730A see *PCARA Update*, June 2021, pp 10-13.

COMPREPPER's video "Ham Radio Power Installation - 2015 Nissan Frontier" is available at: <https://youtu.be/3XbGzdY-uuA> .

Videos on a range of Lido Mounts are available on the 'Lido Radio' YouTube channel: https://www.youtube.com/channel/UC7hq6zxKZFN1Q6ILJ1PW_IQ -Ed.

PCARA makes an appearance

Greg KB2CQE brings the following media event to our attention. On August 20th, BridgeCom Systems Inc. posted a short video on YouTube entitled “3 Fun Things To Do With Your Radio This Weekend”. You can watch the video yourself at the following link:



<https://www.youtube.com/watch?v=XeOJDgLxVio>

The show begins with Dylan Owens KF0EKY asking if you are bored with your radio or just looking for something to do with it this weekend.



Dylan KF0EKY presents the short video by Bridgecom Systems “3 Fun Things To Do With Your Radio This Weekend”.

After “Community Events” and “Travel somewhere remote” the third suggestion is “Meet up with another ham”. At 1:40 Dylan suggests you could easily make a day out of making QSOs together — and a still image pops up showing PCARA’s Special Event Station N2N that was part of the Hudson River Radio Relay on Saturday June 12, 2021.



One suggestion from the video is to meet up with local hams and make a day of making QSOs together. (And look who is doing it!)

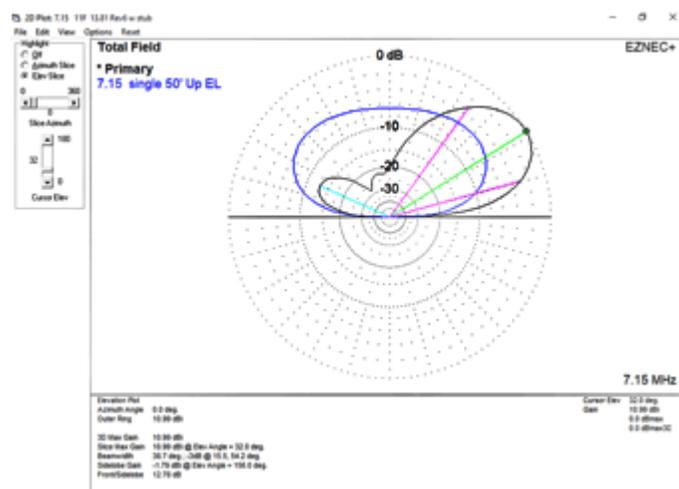
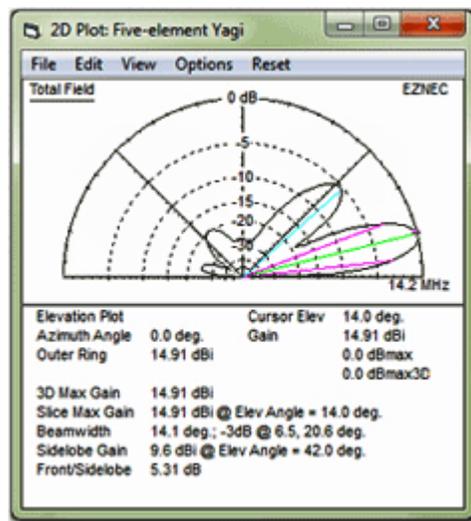
Maybe you recognize the picture... It appeared in the July 2021 issue of PCARA Update in the Special Event report. Be careful not to blink while viewing this video. The shot only appears on-screen for 4 seconds. **Four seconds of fame!** Where will PCARA go next?

Bridgecom Systems has its own channel on YouTube. You can find more information here: <https://www.youtube.com/c/BridgeComSystemsInc/featured> and on BridgeCom’s web site: <https://www.bridgecomsystems.com/>

EZNEC changes

On January 1, 2022, after 31 years of developing antenna modeling software, Roy Lewallen, W7EL will be retiring. At that point, EZNEC will be released to the Public Domain and become free of charge. There will be no further development, sales or support.

Until January 1, 2022, EZNEC sales and service will continue as normal. After that date, there will be no further support and email inquiries will no longer be answered. For more details see: <https://www.ez nec.com/retirement.htm> .



Comparison of 40 meter single inverted-V wire antenna (blue) with 3-element inverted-V wire beam (black) as calculated by Jay NE2Q using EZNEC. (Elevation view.)

The Golden Micro

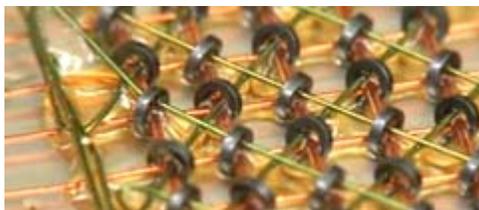
How an Italian physicist opened the gates to a new field

The year 2021 marks the 50th anniversary of Intel producing and selling the first commercial **micro-processor**, the Intel 4004. [This article grew out of an Old Goats Net “Question of the Week” for July 15. - Ed.]

No Moore magnets

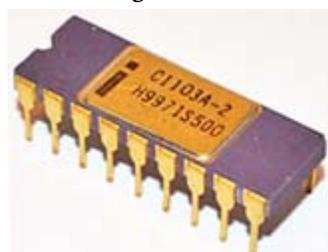
Back in 1971, the Intel Corporation of Santa Clara, California was just three years old. The company was founded in 1968 by chemist Gordon Moore (of *Moore’s Law*) and physicist Robert Noyce after they had left Fairchild Semiconductor. Their intention was to produce semiconductor memory circuits that could replace magnetic core memory, the main type of random access memory used

in large computers of the time. Magnetic core consists of an array of tiny ferri- toroids, strung by



Part of a magnetic core memory board.

hand with thin wires that pass through each core. Current through the wires could change the direction of magnetization and also read the present magnetized state.



Intel 1103A 1kbit DRAM IC.

Thanks to its small physical size and low price it became a best seller, replacing magnetic core memory.

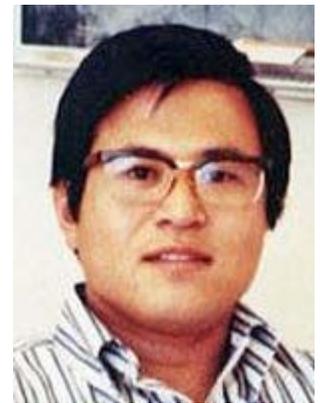
Ideas lift Hoff

In April 1969 Japanese company Busicom, also known as the Nippon Calculating Machine Corporation, approached Intel to design a set of 7-12 custom integrated circuits for its upcoming range of desktop printing calculators. Intel’s head of Application Research **Marcian “Ted” Hoff** (from Rochester NY) examined the Busicom specification. Based on his experience with DEC’s PDP-8 minicomputer and its reduced instruction set, Ted-Hoff lowered the number of



Marcian E. “Ted” Hoff.

chips to just four, echoing the architecture of a general purpose computer, with central processor, DRAM memory and programming stored in ROM. Ted Hoff and Intel’s **Stanley Mazor** worked with **Masatoshi Shima** of Busicom to specify the **MCS-4** project (Micro Computer System) using just four integrated circuits: the 4001 2k-bit ROM with 4-bit I/O port, the 4002 320-bit dynamic RAM, the 4003 shift register for keyboard/printer I/O and the 4004 4-bit Central Processing Unit.



Masatoshi Shima.

Busicom executives agreed to Intel’s proposal and Masatoshi Shima returned to Japan to work on programming and documentation. Unfortunately, Intel was short of manpower, Ted Hoff was moved to another project and no further work took place on the Busicom chip-set for six months.

Made in Italy

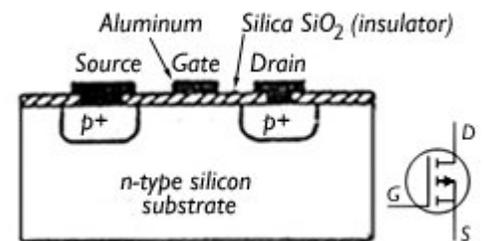
Translation of the four-chip specification into actual silicon was handed over to a new Intel recruit on the day he arrived at Intel in April 1970.

Federico Faggin was born in Italy and prior to university had worked at Olivetti on a transistorized computer, completed in 1961. After graduating from Padua University in 1965

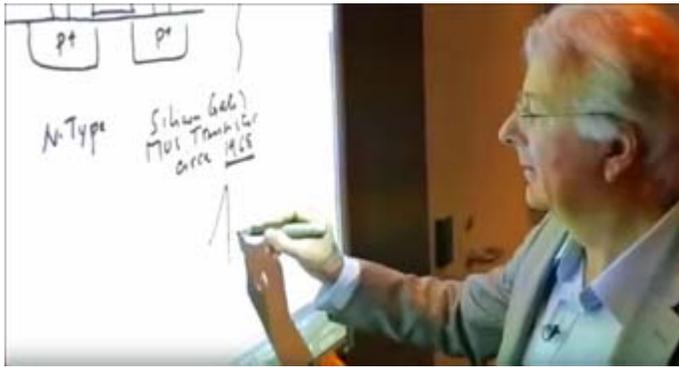
with a Physics doctorate, he worked for SGS-Fairchild in Italy where he developed metal-gate MOS (metal-oxide-semiconductor) process technology and MOS integrated circuits. In 1968 he transferred to parent company Fairchild Semiconductor in Palo Alto, California as a guest engineer. There he developed p-channel MOS silicon gate technology — where the aluminum metal gate of the transistor is replaced by a gate made of heavily doped p-type silicon.



Federico Faggin at Fairchild Semiconductor.



Structure of a PMOS transistor.



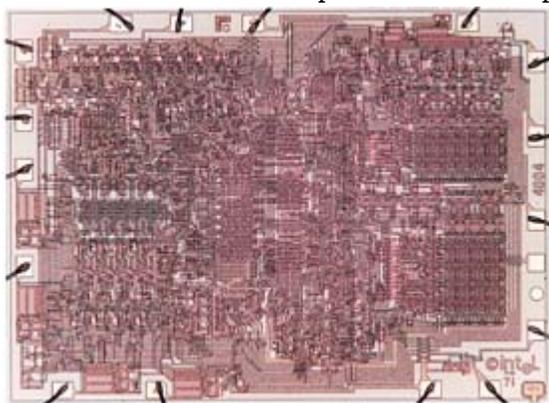
During a 2011 visit to Intel HQ, Federico Faggin sketches the structure of a silicon gate MOS transistor circa 1968.

Hurry up and wait

The week after Federico Faggin took over the Busicom project, Masatoshi Shima arrived from Japan to check on progress — only to be told that nothing had been done since his previous visit. The Japanese organic chemist/engineer was furious!

Federico Faggin worked out a new schedule that would produce samples of the four new chips by December 1970 — a staggering task for a new technology and for a new Intel recruit with no staff yet assigned. Busicom allowed Masatoshi Shima to stay on in California until October 1970 to assist the Italian physicist — who would work 80-hour weeks to get the job done.

Federico Faggin made several decisions about the design of the 4004 CPU chip. It would employ two-phase clock dynamic logic design with “bootstrap loads” on the MOS transistors — a technique he had used at Fairchild to allow logic output at full supply voltage by incorporating a bootstrap capacitor as charge pump to boost the gate voltage. As well as ‘silicon gates’ another technique he had developed at Fairchild was the use of buried contacts — an additional layer of polysilicon to connect silicon gates to source and drain junctions. Dr. Faggin worked from the logic design to the circuit schematic then prepared the chip layout — carrying out much of the work himself, at a time when computer aids were expensive and



View inside an Intel 4004 integrated circuit with 16 external connections, ©intel™ 71 lower right and small initials F.F. top right.

masks were laid out by hand using rubylith masking film. The Intel 4004 chip contained some 2300 transistors, was sized 3 × 4 mm, and was signed in the corner with initials “FF”.

Supply success July 1971

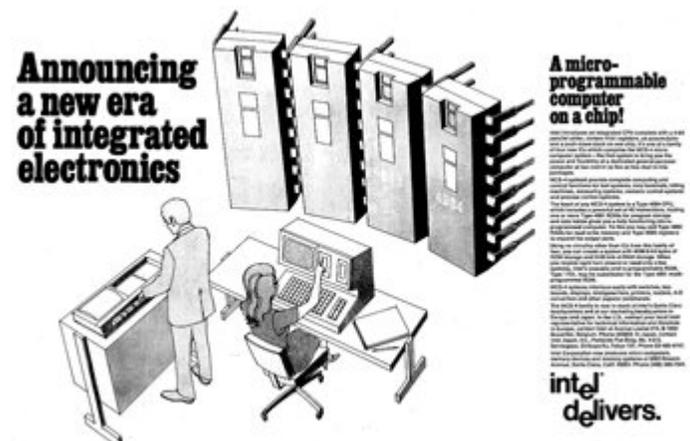
First samples of the 4004 were produced in December 1970 – January 1971 but they failed to work — the ‘buried contact’ masking layer had been left out of the wafer-building process. After correcting mistakes, the sample produced in March 1971 worked successfully. This allowed all four sample chips to be sent to Busicom in Japan for incorporation into their prototype calculator which then worked successfully. Commercial supply of the Intel chip set began in July 1971, allowing Busicom to begin production of their calculator, which incorporated a 29-key keyboard and a Shinshu Seiki type 102 line printer.



Busicom 141-PF desktop printing calculator from 1971 with one Intel 4004 microprocessor, two 4002 DRAMs, three 4003 shift registers and four 4001 ROMs.

Jack of all trades

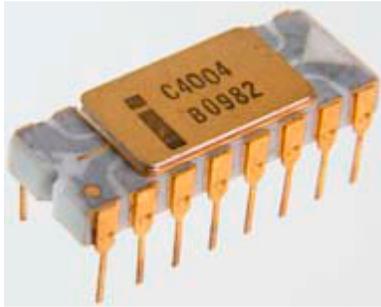
There was a need to test the 2 inch wafers for the 4004 coming off Intel’s production line and Federico Faggin decided to use the 4004 *itself* in a test device. This demonstrated the versatility of the 4004, making it useful not just in Busicom calculators, but for any outside engineer who could program the CPU for different applications. At the time, Busicom had an exclusive agreement for the MCS-4 chip family, but Federico Faggin helped persuade Intel management to give Busicom a price break in exchange for releasing their exclusivity deal. Intel then created a marketing organization and announced general availability of the MCS-4 family of chips in November 1971.



Intel advertisement from ‘Electronic News’ November 15, 1971 announces “A micro-programmable computer on a chip!”

More micros

Beside the Busi-com calculator, suggested applications for the 4004 recalled by Federico Faggin and Ted Hoff included pin-ball machines, traffic light controllers, cash registers, ATM terminals, blood analyzers, gas station recorders and recording devices for farm animals. The 4004 was even considered as a possible component of the Pioneer 10 spacecraft. The chip-set arrangement was patented by Intel in U.S. Patent 3,821,715 "Memory system for a multi-chip computer".



Intel 4004 microprocessor in its 16 pin ceramic DIL package.

Federico Faggin continued his work at Intel, supervising development of the company's first 8-bit microprocessor, the Intel **8008**, which also used p-channel silicon gate technology. This 18-pin device was introduced in April 1972 and was employed in the **Scelbi-8H** computer kit, advertised in *QST* for March 1974. SCELBI Computer Con-



SCELBI Computer Consulting ad from *QST* for March 1974.

sulting had been founded in 1973 by Nat Wadsworth K1MOT, later WK1X. The company manufactured early personal computers then switched to creating software and manuals for the fledgling PC industry.

Federico Faggin went on to develop the improved Intel **8080** 8-bit microprocessor along with Masatoshi Shima who he recruited back from Japan in 1972. The 8080 employed n-channel silicon gate technology (NMOS) for higher speed and was encapsulated in a 40-pin DIP package. Launched in April 1974, the 8080 was used in early personal computers including the Altair 8800 and



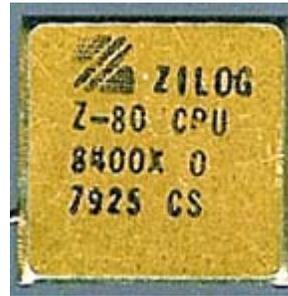
The Altair 8800 computer kit was featured in the January 1975 issue of *Popular Electronics*.

the IMSAI 8080.

A long series of articles on microprocessors featuring the 8080 appeared in *Ham Radio Magazine* from December 1975 to September 1977. The authors were David Larsen WB4HYJ, Peter Rony, and Jonathan Titus.

Farewell to Intel

Federico Faggin left Intel in 1974 to cofound Zilog, the first company dedicated to manufacturing micro-



Zilog Z-80 microprocessor, introduced in 1976.

processor chips. He was joined by Masatoshi Shima in 1975 and both were heavily involved in design of the Zilog **Z80** microprocessor, with Faggin once again working 80-hour weeks. The Z80 was much improved over the 8080 and enjoyed great success.

Some products that employed the Z80 include the Radio Shack TRS-80, Sinclair ZX80, ZX81, ZX Spectrum and Timex Sinclair 1000 plus many video games.

Meanwhile, microprocessors began to be incorporated into amateur radio. In 1977, Lou Dorren, WB6TXD, described a controller for the WR6ABM repeater on Mount Wilson, based on a Motorola 6800 microprocessor. In 1978, the Icom IC-280 2 meter FM transceiver became the world's first amateur radio equipped with a microcomputer in its main unit. The processor was a custom-programmed Texas Instruments TMS-1000.



Icom IC-280 2 meter FM transceiver from 1978 was the first model to include a microcontroller. It had three memories and a detachable front-panel unit.

In 1986 Federico Faggin co-founded his second startup, Synaptics, to develop human interface devices that included the touchpad, touch-displays and fingerprint sensors.

In October 2010 Ted Hoff, Federico Faggin and



Stanley Mazor were awarded the National Medal of Technology and Innovation by President Obama for the conception, design, development and application of the first microcomputer.

- NM9J

Field Day feedback – NE2Q

[Following the ARRL Field Day report in *PCARA Update* for July 2021 pp 9-13, Jay NE2Q contributes some further observations.]

Triband HF beam on mobile tower

The tribander at 22 feet high was probably too low for good 20 meter performance. Forty feet should be the minimum for this band.

[Height of the HyGain TH3Jr tri-band beam for 10/15/20 meters was limited because of safety concerns regarding the tilt-over telescopic mobile tower. -Ed.]



TH3Jr tri-band beam.

On light towers

The rope through the west pole was jammed at the top and very difficult to pull. The result was the inability to attain a no-sag catenary to support the wire elements. A main rope with an end pulley should be hoisted at each pole. Secondary ropes to each end of the catenary should then run through the pulleys on each end. This would allow smoother lifting and lowering.



View of east and west light poles, supporting catenary rope for wire beam. (Catenary and feeder are emphasized.)

We had a late start in attempts to launch lines over the east and west poles. The maximum rope height was achieved at the west end with the east pole rope about 8 feet short of maximum.

Forty meter inverted-V wire beam

[Jay's design for a 3-element wire beam fed with 450 ohm ladder line ran into initial problems matching the bal-

anced feeder through an MFJ antenna tuner's balun. The external tuner was then bypassed -Ed.]

Use a 1:1 choke (ferrite bead) balun at the tuner's coax output or at the radio's output if the radio uses an internal tuner. An "ugly" coax choke balun may also work, however we would need to check its effect on final impedance. Check *R* and *X* with an antenna analyzer at the bottom of the 450 ohm ladder line and at the choke, once in line. Record all readings. Measure the actual length of 450 ohm line used. Adding some length may reduce tuning problems. Effects to be estimated using TLW (Transmission Line for Windows) computer program.



Top: W2DU-style ferrite choke balun. Below: "ugly" coax choke balun wound on plastic pipe.

It may be possible to add wire elements for 20 meters to the 40 meter array. A three element 20 meter inverted-V beam should perform better than a lower tribander.

Station layout

Was 40 meters interfering with 20 meter reception this year? [There was no bandpass filter in use at the 40 meter station because of direct connection of ladder-line to the transceiver. -Ed.]

The 6 meter and 40 meter stations should not be within earshot of each other as the loudspeaker audio from the 6 meter radio interfered with reception on 40 meters. Tom K2UQT and I had trouble discerning responding calls on 6 meters versus 40 meters. It could be our old ears!

Pop-up tents with side curtains may be a better choice for wet weather conditions compared to the tarp tied to the dugout fencing. [There was only one good tarpaulin available to cover the baseball dugout. -Ed.]



40 meter station and 6 meter station were set up opposite each other. Operators – Joe WA2MCR and Verle W2VJ.

Headphones should be used to avoid audio-speaker band confusion. Y-type connectors could be employed to allow simultaneous headphone reception by both the radio operator and the logger.

DX worked on 40 meters

[Jay had requested details from the Field Day log about stations worked overnight in **Hawaii** and **Guam** by David K2WPM on 40 meter SSB. Jay then contacted **KH6RS** and **KH2JU** by e-mail to find out what antennas they had been using and how far east they had worked. Replies to Jay's inquiry are shown below. Maui Amateur Radio Club's KH6RS site was described by Karl N2KZ in *PCARA Update* for Feb 2018, p 6. -Ed.]



Stations contacted on 40 meters during Field Day 2021 included KH2JU and KH6RS. [Map by qsomap.org.]

From: Alan AD6E / KH6TU

Subject: Re: KH6RS FD CONTACT

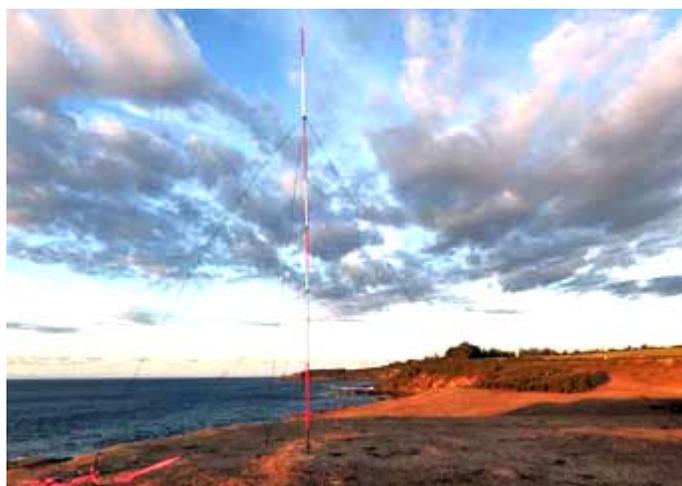
Hi Jay,

We used a simple 40 vertical with two raised radials. It was located near the beach and a nice down slope towards NA. 1500W helps. :-)

<https://photos.app.goo.gl/mtj1yGFjm1rbb8bE7>

<https://photos.app.goo.gl/4pGDxzj4jY3V7FwS6>

Aloha, Alan AD6E / KH6TU



40 meter vertical antenna employed by KH6RS on Maui.



KH6RS Field Day setup also included a U-Haul van.

- . . . - . . . -

From: Danny KH2JU

Subject: Re: Field Day 40 meter Guam contact

Sending you photos of equipment. 700 watts output, 4 el antenna, very few East .

73 Danny



Antennas at KH2JU, Guam.

- 73 de Jay NE2Q

Another birthday

2021 is not just the 50th anniversary of the first commercial microprocessor (see page 9), it is also the **40th birthday** of the **IBM Personal Computer**, first introduced to the public in August 1981 at a press conference in New York City.

Rapid progress

In the years since 1971 when Intel introduced the 4-bit 4004 microprocessor, much progress had been made. Low-cost eight-bit processors appeared including the Zilog Z80 and the MOS Technology 6502 — as used in the Apple II (1977), Commodore PET (1977) and Atari 400/800 (1979). The Z80 was used in the Radio Shack TRS-80 (1977) and Sinclair ZX80 (1980). As costs came down, small systems were adopted by hobbyists, by radio amateurs and by everyday people for home uses such as playing games and learning programming with Microsoft **BASIC**. Advanced microcomputers with a Z80 that included a **diskette drive** would probably employ Digital Research's **CP/M** operating system.



Sinclair ZX80 microcomputer based on the Zilog Z80 8-bit processor.

IBM takes notice

At first, these small systems had little effect on International Business Machines, whose customers were mostly large organizations and scientific institutions — capable of laying out \$90,000 for a System/38 mini-computer or 2-to-9 million dollars for a System/370 mainframe.

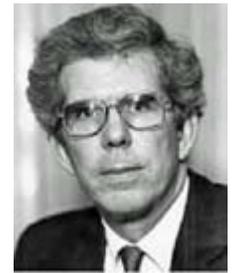


One piece of software available for the Apple II in 1979 was **VisiCalc** — the first spreadsheet program developed for a microcomputer. Small businesses began to purchase a copy of Visicalc with an Apple II for their accounting departments.

IBM recognized a trend. By mid-1980, William Lowe of Entry Level Systems in Boca Raton, FL was visiting CEO Frank Cary at IBM's Armonk, NY headquarters to decide what to do about the upstart industry. Lowe suggested IBM could not just stand by and should either purchase an existing microcomputer company or manufacture a design of its own. He was asked to come up with a design within a month.

Work begins - August 1980

The project was handed over to Don Estridge, who was given the freedom to work outside IBM's traditional design practices that might take four or five years to introduce a new product. He assembled a small team in Boca Raton, some of whom were already familiar with home computers and charged them to come up with a design using off-the-shelf parts that could sell for \$1,500.00. The team would use existing technology to specify an open architecture, standardized product that could be distributed through outside sales channels for quick results.



Don Estridge.

A team of twelve engineers at Boca Raton began work on the new design, drawing a good deal from their recent experience with IBM's System/23 "DataMaster". The DataMaster was a \$9,000 self-contained computer based on the 8-bit Intel 8085 microprocessor with 256 KB RAM and two 8-inch diskette drives. The system, designed for small offices, was capable of running business applications written in BASIC.



IBM System/23 DataMaster.

For their new design, IBM made initial contact with Microsoft to see if they could supply an operating system. According to Bill Gates, Microsoft helped steer IBM toward the Intel 8086, a 16-bit microprocessor with 20-bit address bus. The Intel 8088 variant is code-compatible with the 8086 but only has an 8-bit data bus. This cheaper chip would save money for the ROM, RAM and 8-bit support chips. But Microsoft did not yet have a suitable operating system.

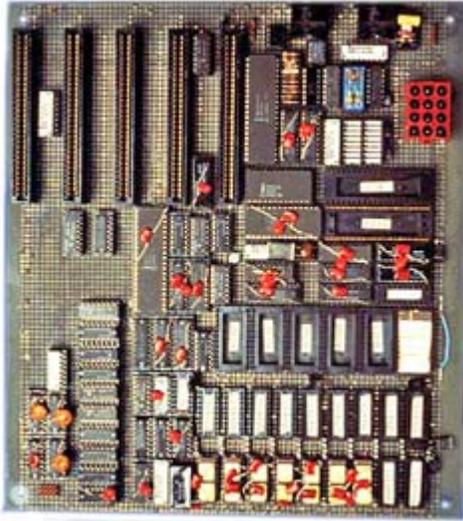


Bill Gates in 1981 (age 26).

After the initial contact with Microsoft, IBM approached Digital Research, supplier of the CP/M disk operating system. According to Silicon Valley legend, Digital Research President Gary Kildall *ignored* the delegation from IBM so he could fly his airplane, leaving his wife to deal with Big Blue — and she refused to sign IBM's non-disclosure agreement. So IBM went back to Microsoft who by then had conveniently found an operating system for the 8086 from Seattle Computer Products. Bill Gates licensed QDOS for \$75,000 and hired SCP's programmer to modify the product for IBM where it would become known as **PC-DOS**. Micro-

soft BASIC would be incorporated into the IBM PC's ROM, so that a diskless machine could boot to BASIC and load or save to cassette. A deluxe machine equipped with the optional diskette drive could boot to PC-DOS and run other software.

The motherboard for IBM's new computer was designed by Senior Associate Engineer Patty McHugh. The initial design was laid out on perf-board with wire wrapped connections in place of the printed circuit board traces. A prototype version went to Microsoft for software testing in December 1980.



Prototype wire-wrap motherboard for the IBM Personal Computer.

Early microcomputers were housed in plastic cases that offered little shielding against unintended RF emissions, leading to interference with TV and radio reception. In 1979, the FCC imposed legal limits on electromagnetic emissions from digital electronic equipment in 47 CFR Part 15 Subpart J "Radio Frequency Devices/Computing Devices". To comply, the IBM PC's

power supply and motherboard were housed inside a wrap-around shielded steel case, strong enough to support a video monitor. The five slots



Rear of the IBM PC's well-shielded metal case with connectors for power out/in, keyboard/cassette and 5 expansion slots.

on the back for adapter cards were covered with tight-fitting metal brackets to prevent radiation.

In order for outside manufacturers to supply suitable adapters, the entire hardware and software specification of the IBM PC was made freely available in the "Technical Reference Manual" This promoted the availability of compatible equipment after launch but it would also provide a path for future competitors to introduce IBM-compatible PC "clones" running MS-DOS.

By using outside vendors for many of the parts and bringing in outside developers for the operating system and application software, IBM's design was finished by April 1981, after which it went to manufacturing.

Big Blue announcement

On August 12th 1981 in a press conference at the Waldorf Astoria Hotel in New York City, the IBM Personal Computer Model 5150 was announced. For \$1565 you could pick up a system unit and keyboard with color graphics capability. The 20" wide system unit contained an 8088 microprocessor clocked at 4.77 MHz, with 16K RAM, 40K ROM and BASIC language interpreter built-in, along with five expansion slots, loudspeaker and cassette interface. The 83-key adjustable-angle keyboard derived from the IBM Data-Master would set a standard for years to come.

Optional items included one or two 160 kilobyte 5¼" diskette drives, monochrome display, dot-matrix printer (by Epson) and RS-232C serial adapter. These items would be available through ComputerLand, Sears Roebuck and IBM Product Centers. A system equipped with all the optional extras,



The original IBM PC of 1981, with twin diskette drives, monochrome display, keyboard and dot matrix printer.

256 kbytes RAM and color graphics might cost \$4500+.

Well received

The new design received a very positive response. While previous microcomputers were too 'hobbyist' for business use, the "IBM" name on a system granted an air of official approval and respectability that encouraged professional organizations to look into the new technology. Sales exceeded IBM's expectations, with some quarter million systems sold by the end of the year.

Worldwide

IBM is an international company and the IBM PC was made available worldwide by January 1983. At that point your editor was on the other side of the pond, where my employer had decided to adopt the IBM PC as its company standard. I attended a presentation on the new technology in March 1984, followed by a visit to Division HQ in Amersfoort in September 1984 for a week-long Microcomputer Course covering the main applications. Shortly afterwards, beige boxes began arriving on the desks of our accountants and secretaries, complete with a copy of Lotus 1-2-3 or Word-Star. After that, we never looked back... to the bad old days of hand-written research reports that had to be typed, proofed, retyped, re-proofed and typed again.

- NM9J

Look! Up in the Sky!

- N2KZ

I saw it with my radio! Cosmonauts aboard the International Space Station were sending slow scan television pictures to the world as they orbited the Earth on Saturday morning, August 7, 2021. Using an impressive and complex 50 watt Kenwood TM-D710

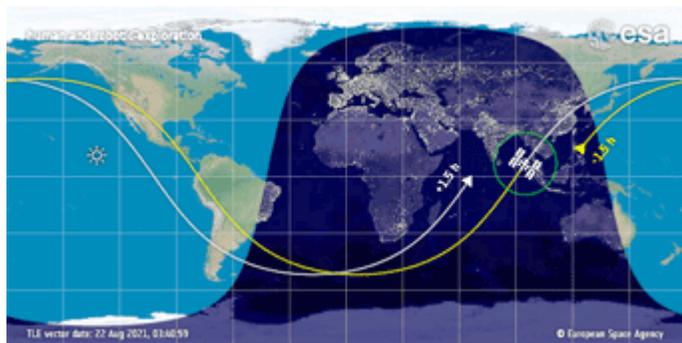


TM-D710 dual-band FM transceiver.

transceiver specifically enhanced for data, many single frame images were transmitted from the ISS on 145.800 MHz FM simplex in PD-120 format to the delight of earthbound amateurs and ISS fans.

My receiver was my trusty Yaesu FT-1900 mobile connected to an Arrow 4-element Yagi. This is the same outfit I use for PCARA's weekly Old Goats Net. I connected the Yaesu's audio output to a modest little Dell laptop using free-to-download MMSSTV software using 'Auto' mode. Resolving the pictures was a breeze! It recognized the Space Station's PD-120 format transmission instantly.

How do you know when the ISS will pass your QTH? Highly recommended is the Live Space Station Tracking Map available at: https://spotthestation.nasa.gov/tracking_map.cfm. Not only can you see where the ISS is currently, but it also reveals exactly where the ISS will travel during its next pass about 1.5 hours later.



International Space Station live tracking map.

On August 7th, the SSTV broadcasts were scheduled for 0550 to 1155 EDT. Watching the ISS progress on the live map, I determined that my best opportunity for reception would be from about 11:20 a.m. to about 11:40 a.m. Saturday morning. The ISS would pass several hundred miles over the Atlantic Ocean and nearly dead south from my QTH.

I positioned my Yagi and patiently waited and listened and listened and waited. It was almost 11:30 a.m... Right out of the murk of static, I heard a very weak synchronization-start warble and my com-

puter began to resolve an image! As the ISS came closer and closer, the signal vastly improved. Just as the picture concluded, the signal faded away.



Slow-scan TV picture from the International Space Station received by Karl N2KZ on 145.800 MHz, August 7.

In retrospect, I may have missed a second opportunity. Malcolm NM9J was also receiving the ISS pictures and also heard the first picture end and the carrier drop. Maybe I wasn't patient enough, but Malcolm

grabbed a second image a few moments later. Did I give up too quickly? Maybe I did!

Malcolm was using a Yaesu FT-991A multimode rig with a Diamond X-200



Second, noisier image received at NM9J.

vertical antenna up on his roof along with a more advanced version of MMSSTV software called YONIQ. Read all about it: <https://hamsoft.ca/pages/mmsstv-yoniq.php>. Malcolm's images appear with better resolution and frame synchronicity than the images I resolve with older MMSSTV. Highly recommended!

Considering this was my first attempt in receiving images from the ISS, I was very proud of the results. The images looked very similar in format and style to what others have seen in the past. I wonder why the frames Malcolm and I received showed 'July 2021' in both frames? Were they created for another event?

Want to try to receive ISS pictures too? Keep up with the ISS image transmission schedule at: <https://ariss-sstv.blogspot.com/> Reception instructions: <https://amsat-uk.org/beginners/how-to-hear-the-iss/> and more... <https://amsat-uk.org/beginners/iss-sstv/>. See? There are pictures up in the sky... and you can see them with your radio!

- N2KZ

Peekskill / Cortlandt Amateur Radio Association

Mail: PCARA, PO Box 146, Crompond, NY 10517

E-Mail: mail 'at' pcara.org

Web site: <http://www.pcara.org>

PCARA on Facebook: <http://facebook.com/pcarahamradio>

PCARA Update Editor: Malcolm Pritchard, NM9J

E-mail: NM9J 'at' arrl.net

Newsletter contributions are always very welcome!

Archive: <http://nm9j.com/pcara/newslett.htm>

PCARA Information

PCARA is a **Non-Profit Community Service**

Organization. PCARA meetings take place the first Sunday of each month (apart from holidays, July/August break and pandemics). Talk-in is available on the 146.67 repeater.

PCARA Repeaters

W2NYW: 146.67 MHz -0.6, PL 156.7Hz

KB2CQE: 449.925MHz -5.0, PL 179.9Hz

N2CBH: 448.725MHz -5.0, PL 107.2Hz

PCARA Calendar Masks / Social Distancing may be required.

Sat Sept 11: PCARA Membership meeting, 9:00 a.m., John C. Hart Memorial Library*, 1130 E Main St., Shrub Oak, NY. Outdoors, bring your own chair.

Sat Sept 11: PCARA V.E. Test Session, 11:00 a.m., John C. Hart Memorial Library*, Shrub Oak. Outdoors. See below.

**Please avoid Gazebo at SW corner which is a 9/11/01 memorial.*

Sat Sept 25: PCARA Breakfast, 9:00 a.m., Downing Park Pavilion, 2881 Crompond Rd. (Rt 202) Yorktown.

Hamfests Check with organizers before leaving.

Sun August 29: Candlewood ARA Western CT Hamfest, Edmond Town Hall, 45 Main St., Newtown CT. 8:00 a.m.

Sun Sept 12: Orange County ARC Hamfest, Town of Wallkill Community Center, 2 Wes Warren Dr., Middletown NY. 8:00 a.m. **PCARA Club Table.**

VE Test Sessions Check with contact before leaving.

Sep 4, 11, 18, 25: Westchester ARC, 19 Hunts Bridge Rd, Yonkers NY. 12:00 noon. Must contact VE, (914) 237-5589.

Sep 8: WECA, Westchester County Fire Training Center, 4 Dana Rd. Room 3, Valhalla NY. 7:00 p.m. Contact Stanley Rothman (914) 831-3258.

Sep 11: PCARA, John C. Hart Memorial Library, 1130 E Main St., Shrub Oak NY. 11:00 a.m. Must contact Michael W2IG w2igg'at'yahoo.com, (914) 488-9196. **Call ahead.**

Sep 12: Orange County ARC Hamfest, Middletown NY, 9:00 a.m. Contact Joseph J. DeLorenzo, (845) 534-3146.

Sep 17: Orange County ARC, Munger Cottage, 183 Main Street, Cornwall NY. 6:00 p.m. Contact Joseph J. DeLorenzo, (845) 534-3146, w2bcc'at'arrl.net



Peekskill / Cortlandt Amateur Radio Association Inc.

PO Box 146

Crompond, NY 10517