Zero Retries 0103 - by Steve Stroh N8GNJ

Steve Stroh N8GNJ

Zero Retries is an independent newsletter promoting technological innovation in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology.

About Zero Retries

Steve Stroh N8GNJ, Editor

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Web version of this issue - https://www.zeroretries.org/p/zero-retries-0103

Request To Send

Editorial by Steve Stroh N8GNJ

This is a crunch week for our family to prepare for a major event on Saturday. I'm completing this issue early in the week, and then I will be in full saturation mode on household tasks to prepare for the event. What little time I'll have other than event preparations will be for a new personal project…

Writer for M17 Project

In Zero Retries 0100 I wrote Perspective - Project Websites Without a News Section Hurt the Project. One example I cited was the M17 Project:

> **M17 Project** - (No News section) In Zero Retries 0099, I mentioned M17 OpenHT - A Breakthrough In Ham Radio. One week later there is still no mention of that significant advancement within M17 Project on the M17 Project website. That information was *only* found on Reddit Amateur Radio Developers. (Not to mention, Zero Retries apparently doesn't meet M17 Project's definition of "Media".)

Recently, Wojciech Kaczmarski SP5WWP posted on Facebook a mention of a (very Zero Retries Interesting) prototype of the OpenHT. Hoping to stir things up, I commented on Facebook:

> Looking forward to this being posted to a web page so it can be linked to.

To which SP5WWP replied:

> Steve Stroh would you like to help us with that by creating content?

I said yes, and thus I come full circle with M17. At one point, years ago now, (prior to starting Zero Retries), I filled out a contact form or some other communication offering to get involved in the M17 Project… but didn't receive a response. Over the past two years of writing Zero

Retries, often citing M17 Project as a specific example of technological innovation in Amateur Radio, both M17 Project and I have grown aware of each other.

So, having been extended an invitation to help "be part of the solution", now I am a "writer" for M17 Project thanks to Steve Miller KC1AWV, the webmaster of the M17 Project's website.

Mostly, per my plaint above, I'll be "hoovering up" mentions of M17 Project's progress posted in various "conversational mediums" and reformatting such mentions and posting them on the M17 Project's web page in the new News section (still a work in progress).

I'll have more to say about my take on M17 Project in future issues of Zero Retries, once I can get all the queued up "recent cool stuff" posted onto the M17 website.

Amateur Radio Moonshots - My Presentation for MicroHAMS Digital Conference 2023

By Steve Stroh N8GNJ

I was invited to be a presenter at the MicroHAMS Digital Conference (MHDC) 2023, that was to occur in May, 2023. MHDC 2023 was canceled - this article is the essence of the presentation I would have given.

MHDC Chairperson Scott Honaker N7SS got my attention with this intriguing email:

> In 2015, Fareed Zakaria created a show called "Moonshots". The premise was pointing out that going to the moon wasn't our last big accomplishment. He featured a number of emerging technologies that had the potential to be the next revolutionary accomplishment. I don't remember them all but they were fantastic; 3D printing organs, curing cancer, CRISPR, etc. I subscribed to the CNN streaming service just in the hope I could see this again, then they pulled it a day before it went live.
>
> You are in a unique position to see these events unfold in the amateur radio community. I think an MHDC talk like this could be very inspirational. What are the 5 things that show the most promise to revolutionize amateur radio? Are you willing to tell us?

My Thanks to N7SS for the thought-provoking suggestion. I devoted an entire issue of Zero Retries to a number of ideas, including some Moonshots - Zero Retries 0079 - 2022-12-30 - A Vision for Zero Retries Interesting Amateur Radio in 2029. In that issue I explored more than five things, and some things were linear extrapolations of current trends, not (what I would consider Moonshots), so what follows is a distillation and update from that issue.

Moonshot 1 - An New Amateur Radio Organization for the 21st Century

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This is easily the most ambitious Amateur Radio Moonshot. By comparison, the other Moonshots are straightforward funding / development / management challenges. The creation of a "C21 ARO" requires an *entirely new way of thinking* within Amateur Radio.

Current US Amateur Radio organizations were created in the 20th century, and their culture, operations, outlook, and membership reflects that heritage… and baggage. My sober assessment is that those organizations cannot overhaul their legacies to scale / morph into organizations that can rise to the challenges confronting Amateur Radio in the 21st century.

Here are some aspects of a C21 ARO:

- Focus on appealing to younger generations, including a comprehensive Code of Conduct

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  . How can Amateur Radio be presented to be interesting *to them*?
- Focus on appealing to technologists (techies), and highly technically capable because being affiliated with the organization is attractive to high-level technologists.

- Geographically inclusive over all of North and South America and all countries.

- Internet-based organization (entirely virtual).

- Open source - all information, resources, etc. are publicly available.

- New funding models - instead of "rent extraction" (membership fees), develop funding sources such as donations and endowments from tech billionaires, foundations, etc.

- Local chapters based on standardized resources - branding, operations, available resources, etc.

- Well-developed training - standardized, well-produced video tutorials, classes, conferences, etc. Modules and support are developed to easily integrate Amateur Radio into STEAM curriculums.

- Effective marketing to youth and the general public.

- It's feasible for the FCC and other national spectrum regulators to "outsource" spectrum management, including operator licensing for Amateur Radio.

The conventional wisdom is that such a radical change within Amateur Radio, with more than a century of tradition, is impossible. But in my lifetime I've seen ample "impossibilities" - the original Moonshot, the end of endemic diseases like polio, effective solar power, personal

computers, and ubiquitous (ambient) broadband Internet access to name just a few.

Each of those began in someone's imagination, and they worked to make it a reality until it *became* a reality. To accomplish any of the following Moonshots, in my opinion, requires a new Amateur Radio Organization for the 21st Century.

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Moonshot 2 - Western Hemisphere GEO Satellite / Payload

(Reference - AmGEO-200 - Western Hemisphere GEO Payload)

In my opinion, an Amateur Radio payload (using Amateur Radio frequencies, likely 5 GHz uplink, 10 GHz downlink) in geosynchronous / geostationary orbit (GEO) would be a huge boon for Amateur Radio in the Americas. It would accelerate interest in microwave technology within Amateur Radio, it would make it feasible to link widely separated Amateur Radio data networks without using Internet, and it would put microwave communications in Amateur Radio on a par with the utility of HF operations to work between widely separated Amateur Radio operators.

A recent article in Ars Technica - Internet from a small satellite in geostationary orbit? Sure, why not has given me hope that a Western hemisphere GEO Satellite / Payload *might… now be feasible!*

> A startup space company says it has successfully deployed and tested a kitchen-stove-sized satellite in geostationary orbit and begun delivering Internet service to Alaska.
>
> Earlier this month, the 'Arcturus' satellite, built by a company named Astranis, launched as a rideshare payload on a Falcon Heavy rocket, separating a few hours after liftoff and successfully deploying its solar arrays, boom, and a subreflector.

In my rudimentary "understanding" of GEO satellite operations, I had always assumed that the GEO orbital slots above the Western hemisphere were so valuable that only large satellites, engineered for long lifetimes and maximizing commutations capability (many spot beams with corresponding complex antennas), requiring a dedicated launch, were feasible for GEO operations.

But Astranis has apparently figured out how to manufacture, launch, and operate GEO satellites "on the cheap" (at least, cheap*er*, compared to traditional GEO satellites). Thus, perhaps an Amateur Radio version of the Arcturus satellite, engineered by Amateur Radio technology (already developed based on the previous attempt at an Amateur Radio GEO payload), funded by ARDC, built by Astranis, and launched via (less expensive) SpaceX Rideshare *might* be within the ragged edge of feasibility.

Another "cheap GEO" concept seems to be PRECURSOR (though I don't understand how it can be said to be Geosynchronous at 460 km when an orbit that orbits at the same speed as Earth's rotation is 35786 km). Unlike Astranis, PRECUROR seems amenable, even eager to provide Amateur Radio satellite communications.

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There is a dormant discussion group for this concept - https://groups.io/g/GEO that I will be "stirring up" in coming weeks. *(Update - apparently this group is effectively dead; I posted to it, and nothing happened.)*

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Moonshot 3 - An Open Source, Software-defined, New Paradigm for Amateur Radio VHF / UHF Operations

In the 2020s, with Software Defined Radio (SDR) a reality for more than two decades now, it's… *insane* that Amateur Radio VHF / UHF spectrum is technologically divided by incompatible *modes*. A radio built for Digital Mobile Radio (DMR) cannot operate using digital voice on a repeater built for D-Star. And only D-Star (partially) makes an accommodation for data over D-Star repeaters.

Collectively, Amateur Radio has an incredible capability in the thousands of VHF / UHF repeaters. The problem is that such repeaters are almost exclusively reserved for voice use, and silo'd, proprietary digital voice systems, thus *Amateur Radio* repeaters are now often almost entirely unused, and regarded as a technological anachronism.

In the 2020s, it's past time to rethink the vision of Amateur Radio VHF / UHF repeaters for the 21st century. Some features of a "Century 21" (C21) repeater:

- Based on Open Source and SDR technology - the operational parameters of the repeater can be updated with software.

- While the reality of repeater operations in high-density sites probably preclude easily changing transmit frequencies, an SDR receiver(s) are a normal part of a C21 repeater. Thus repeaters can be linked, perhaps even dynamically, by listening to another repeater's transmissions. One example of using this capability is a "flood protocol" where a bulletin could be broadcast by one repeater, and when appropriate, rebroadcast by other repeaters.

- Single-frequency repeaters - now feasible using Time Division Multiple Access (TDMA) protocols. This has already been demonstrated by modifying DMR's two time slots (normally used for two independent channels) for simultaneous receive and transmit on a *single* channel.

- C21 repeaters can be aggregated. For example, digital video requires a minimum bandwidth which isn't available on a single repeater (using conventional 25 kHz channels). C21 repeaters can, on demand, aggregate together to provide a minimum bandwidth such as 4 repeaters on a single site aggregating into a 100 kHz channel. If this seems like fantasy, keep in mind that an SDR "just handles" these sorts of complexities - merely bits to be received, or transmitted in a specified pattern / frequency(ies).

- C21 repeaters can transfer data as easily as voice - "bits are bits" - voice is just a bitstream with a "voice" tag. C21 repeaters are also considered to be usable not just for human use, but for Amateur Radio computers to "file sync". In the wee hours when there is no human usage, C21 user radios use otherwise wasted airtime to transmit Amateur Radio callsign database updates, bulletins, low-priority email messages, satellite predictions, tutorials, etc. The airtime costs nothing, and it demonstrates a capability unique to Amateur Radio.

- User radios for C21 repeaters are inexpensive because they're based on open source designs that are largely software - basically big Digital to Analog (D/A) and Analog to Digital (A/D) converters, a Field Programmable Gate Array (FPGA), a processor

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  , and a power amplifier… all of which are getting cheaper and cheaper. The rest is software. An early example of such a radio is the RPX-100.
- Experimentation is encouraged. C21 repeaters, and user radios, are software defined, and based on Open Source, thus the barrier to changing something about the operation of a repeater or a radio is low; if something doesn't work, the base level of software can easily be reloaded.

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Moonshot 4 - Amateur Radio Megaconference

One of the largest technical conferences is DEFCON, held annually at a major conference facility in Las Vegas, Nevada. *Everyone* involved in Information Technology is aware of DEFCON, and I'll guess that most technical personnel in the IT industry aspire to attend DEFCON at least once.

In Amateur Radio, Hamvention is the largest Amateur Radio conference in the world, held annually in Dayton and now Xenia, Ohio at a county fairground.

Attendance at both events is ~ 30,000 people. Both conferences attract those who are "hands-on", directly involved in IT and Amateur Radio

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DEFCON attracts major corporate sponsors to underwrite the event, attendance is often paid for by employers, the event lasts 4+ days, has many specialty meetings, and takes place in the resort city of Las Vegas in a huge convention venue.

In my opinion, one of the primary differences between DEFCON and Hamvention is the perceived value of attending the conference. At DEFCON, IT personnel are exposed to valuable information that equips one to better do their job within IT.

Hamvention attracts many who are involved professionally in radio technology, but information presented at Hamvention is largely "hobbyist" information.

A C21 ARO could rethink an annual conference for Amateur Radio and expend the funds to start an Amateur Radio / Radio Techology Megaconference. Such a conference could also be held in Las Vegas (one of the few places that can accommodate at conference with attendance of 30,000). It could advertise the new conference heavily (not just to those already involved in Amateur Radio). A C21 ARO could recruit vendors deeply involved with radio technology to recruit new personnel for positions requiring knowledge of radio technology. Here's just a *few* such vendors that come readily to mind, from a variety of industries for whom *innovative* radio technology is critical:

- Qualcomm and Qorvo - radio chipsets;

- Tektronix and Rohde & Schwarz - radio systems test equipment;

- Boeing and Honeywell Aerospace - commercial aircraft radio communications;

- L3Harris and US Army Signal Corps - military radio communications;

- Tarana Wireless and Cambium Networks - Wireless Internet Service Provider infrastructure;

- Mimosa Networks and HXI - Point-to-Point and Point - Multipoint microwave infrastructure;

- AT&T, T-Mobile, and Verizon - radio-based telecommunciations carriers

- Ericsson and Nokia Networks - radio-based telecommunications infrastrucure.

An Amateur Radio / Radio Techology Megaconference would be expensive and discouraging in the first few years, which is why a C21 ARO would have to be prepared to invest for the long view, but I think it would pay off as the attendance grows.

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Moonshot 5 - Four *Mini* Moonshots

This fifth Moonshot is a minor cheat of the original premise. While these aren't quite Moonshots (comparable in magnitude to the first four), they do require a "heavy lift" to implement. IE, these aren't achievable without considerable organization, sustained effort, and significant funding.

Moonshot 5A - Custom AREDN Radios

AREDN Mesh Networks are an under-utilized capability in Amateur Radio, especially in the semi-exclusive Amateur Radio portion of the 2.4 GHz band. Use of AREDN is handicapped by the hardware used for AREDN built for license-exempt (Part 15 and other country's equivalent regulations) operations. Amateur Radio would benefit from being able to use built-for-purpose Amateur Radio units with larger memory (improved mesh network functionality), higher transmit power, and native 12 volts DC operation.

Moonshot 5B - GNU Radio for Amateur Radio (GR4AR)

GR4AR is a concept that makes the versatile and powerful GNU Radio and "localizes" it for Amateur Radio. Some features of GR4AR might include built-in knowledge of Amateur Radio bands and operational characteristics, built-in modes that are popular with Amateur Radio, Software Defined Radio hardware that is used in Amateur Radio (such as the ADALM PLUTO) and a "friendlier" user interface for Amateur Radio Operators. For example, GR4AR would ask for country, and license class, and allow transmission only on frequencies and modes that are legal for that license class in that country.

Moonshot 5C - Power Amplifier for VHF / UHF Software Defined Transceivers

Amateur Radio now has numerous Software Defined Transceivers (SDT) for VHF / UHF, such as the aforementioned ADALM PLUTO, that are sufficiently capable for Amateur Radio use, and the enabling software is getting better by the week.

Amateur Radio has long used external power amplifiers such as the MFJ / Mirage B-34 to amplify a low power signal (2 watts) to a higher power (35 watts). But such amplifiers are unsuitable for SDTs. One deficiency is that the transmit power of the SDT is considerably below the minimum input power for such amplifiers. A second deficiency is that SDTs are *all-mode*, but conventional amplifiers are designed only for FM signals. Thus a new class of power amplifiers, specially made for SDT's (low input power, capable of all-mode operation) is needed. Designing such an amplifier isn't rocket science, but it's not trivial either, especially given the shortage of parts that are easy to design with. One early example is the LimeRFE, but its transmit power on VHF / UHF is approximately 0.5 watts - not very effective

in the real world. Thus, such an amplifier will require significant design skill and capital to get such systems into production. Perhaps, given the trend of open source designs to be widely copied by Chinese vendors, that will be enough to drive prices down and availability up.

Moonshot 5D - Amateur Radio Focused ChatGPT

ChatGPT is a capable Artificial Intelligence system, but it has trouble with context. Imagine if a ChatGPT could be focused on Amateur Radio's vast (more than a century now) pool of information? It would be, in effect, a virtual mentor

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. As in ingests *all* the Amateur Radio magazines… *all* the Amateur Radio books… *all* the Amateur Radio videos, podcasts, blogs, newsletters, etc. I've had moments like the above talking to people that are the equivalent of such a focused AI - those who are subject matter experts on Amateur Radio data communications, Amateur Radio satellites, Amateur Radio antennas, etc. It's a transcendental moment when you can ask a poorly formed question and get a tailored response from deep knowledge and experience.

Like the other Mini Moonshots, how to accomplish this is straightforward - ChatGPT (and equivalent open source AI systems) *is* available for use, and a good start of the source material is now publicly available thanks to Internet Archive's Digital Library of Amateur Radio & Communications (DLARC). Getting to an Amateur Radio Focused ChatGPT is largely a matter of organizing a team, building it, and sustainable funding and maintenance.

Leave a comment

Share

ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

VarAC 7.3.0

The primary new feature in VarAC 7.3.0 is an integrated image handler with compression.

📢 Introducing: Image compression

VarAC now offers a convenient image compression tool with a unique twist. Taking inspiration from SSTV, you have the option to incorporate your own callsign and SNR reports directly into the image. This distinctive feature sets it apart, ensuring a personalized touch to your compressed images.

Other significant new features include:

Alert center - one screen with all alerts. Great for daily use as well as Emcomm operations.

Logging QSOs to Winlog32 logger.

My thanks to Pseudostaffer Jeff Davis KE9V for alerting me to this.

Messing with the Beepberry

Image courtesy of Jeff Geerling KF0MYB

Jeff Geerling KF0MYB is off to a great start with his new Amateur Radio license in discussing interesting radio technology. He offers a brief introduction to the Beepberry.

> On the back, room for a Raspberry Pi Zero W, or Zero 2 W—or, considering the Pi shortage, some Pi-compatible clones. Then there's a space for a little battery pack, which, when installed, covers up the integrated RP2040 microcontroller and some other circuitry.
>
> Unlike many similar projects that came before, this thing has pretty much full feature support out of the gate, and it only took me about 10 minutes to go from box to fully booting.

Keep in mind that the Raspberry Pi Zero 2 W has integrated Bluetooth and Wi-Fi. I can easily imagine pairing a Beepberry via Bluetooth with a portable radio or a Go-Kit.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out **Join the Fun on Amateur Radio** for some pointers.

Zero Retries Frequently Asked Questions (FAQs) — In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to everyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing *Thanks* to:

- Tina Stroh KD7WSF for, well, *everything!*

- **Pseudostaffers** that write about about "Zero Retries Interesting" items on their blogs that I don't spot:

  - Dan Romanchik KB6NU

  - Jeff Davis KE9V

- **Newsletters** that regularly feature Zero Retries Interesting content:

    - Amateur Radio Weekly by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories.

    - Experimental Radio News by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC.

    - TAPR Packet Status Register has been published continuously since 1982.

    - Other Substack Amateur Radio newsletters recommended by Zero Retries.

- **YouTube channels** that regularly feature Zero Retries Interesting content:

    - HB9BLA Wireless by Andreas Spiess HB9BLA

    - KM6LYW Radio by Craig Lamparter KM6LYW (home of the DigiPi project)

    - Modern Ham by Billy Penley KN4MKB

    - Tech Minds by Matthew Miller M0DQW

- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click below to join ~~100~~ ~~200~~ ~~300~~ ~~400~~ *~~500~~* ~~600~~ ~~700~~ *800+* other readers:

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Share Zero Retries

Offering **feedback or comments** for Zero Retries is equally easy — just click:

Leave a comment

If you're a fellow smart person that uses **RSS**, there *is* an **RSS feed for Zero Retries**.

Zero Retries (N8GNJ) is on Mastodon — n8gnj@mastodon.radio — just click:

Zero Retries / N8GNJ on Mastodon

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog — *Discussing new generations of Amateur Radio Data Communications — beyond Packet Radio (a precursor to Zero Retries)*

- N8GNJ blog — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs — Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA.

2023-06-16

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1
Many current generation folks look for the presence of, and the particulars, of an organization's Code of Conduct before even considering participation. No Code of Conduct = an organization not worth considering.

2
My thanks to Pseudostaffer Jeff Davis KE9V for alerting me to this development - New GEO Satellite Info.

3
The conventional wisdom is that embedded processors have gotten very cheap and very capable that it can't get much better. But, RISC V open source processor architecture, the "ARM tax" and "Intel tax" is non-existent and any company can create new variants of processor based on RISC V.

4
There is already a significant, and growing, Amateur Radio representation at DEFCON.

5
In older Amateur Radio terminology, a virtual Elmer.