11 & 12 October 2025

Hamfest India 2025 Goa

Connecting Waves
Inspiring Innovation

35 YEARS OF HAMFEST IN INDIA

A Celebration of HAMs

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For the Amateur Radio Community
Celebrating Innovation & Fellowship


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At RFCharge, we specialize in high-performance telecommunication solutions built for critical infrastructure, defence, marine, aviation, and Hamradio R&D sectors.
Our mission is to empower seamless, reliable communication across industries through cutting-edge wireless technology, trusted global partnerships, and nationwide reach.

Message from the Convenor

When HamFest India was first hosted in 1991, it wasn't just an event it was a gathering of kindred spirits, a place where ideas, friendships, and passion for radio met without boundaries. Over the years, this tradition has travelled across India, each host adding their own flavour while keeping the essence alive.

This year, that privilege and responsibility has come to Goa. For our team, it's not about putting on a show, it's about creating a space where every delegate feels a sense of belonging. A space where the old hands can share wisdom, the new HAMs can feel inspired, and where we can all walk away with stories to tell.

HamFest India 2025 is not only about technical sessions, workshops, and demonstrations – though there will be plenty of those it’s also about the tea breaks, the late-night rechews, the “aha” moments when you learn something new, and the smiles when you finally meet a callsign you’ve only heard on the airwaves. These friendships often outlast the event itself and are what keep our community alive long after the closing ceremony.

Organising an event of this scale also means dealing with logistics, planning, and a fair amount of coordination. It’s not always visible, but a lot happens in the background to make sure things run smoothly. My hope is that delegates find the arrangements simple and convenient, so the focus stays on radio and learning, not on hassles.

I am deeply grateful to everyone who has supported us so far, the volunteers, partner organisations, and HAMs from every corner of the country and to those who have travelled great distances to be here.

See you around the venue in the seminar halls, at the stalls, or perhaps just across a table, talking about the magic of Amateur Radio.

73,
Sandesh Bhat
VU22DX / Ex VU3FGJ
General Convenor - HamFest India 2025

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HAM Radio: A Technical and Social Hobby for Anyone and Everyone

by YL Neil Bruce (VU3EFZ)

HAM radio, often celebrated for its technical prowess, is much more than just a technical hobby. It offers a unique blend of technical challenge and social connection, inviting people of all genders, backgrounds, and abilities to participate. As a field that combines hands-on experience with learning and community-building, HAM radio holds a special place for hobbyists who are drawn to both technology and friendship, making it an inclusive platform for everyone.

On the surface, HAM radio may appear to be purely about electronics, antennas, and frequency modulation. While these technical aspects are essential, they form only part of the HAM radio experience. From setting up DIY projects to exploring new advancements in communication, Amateur HAM operators are constantly learning and adapting. However, every transmission offers an opportunity to connect with someone new, often from a completely different background or part of the world. These connections turn technical experimentation into shared experience, making HAM radio as much about people as it is about machines.

This social aspect of HAM radio is a key factor that keeps people engaged. It allows operators to communicate across borders and build friendships that span continents. The HAM radio community is one of camaraderie and collaboration, where operators support each other in troubleshooting, teach newcomers, and even organize local and international gatherings. These connections aren't limited to language, nationality, or age—they include anyone who shares a passion for radio.

Events like HAMFEST INDIA illustrate how amateur HAM radio goes beyond the technical to foster personal relationships and unite people under a shared interest. In fact, operators, whether experienced or just starting out, often describe this hobby as a "global family as we here like to call it Vasudhaiva Kutumbakam" It's a space where anyone can belong and contribute, regardless of prior knowledge or expertise.

Perhaps one of the most remarkable qualities of ham radio is its inclusivity. This hobby is open to everyone—regardless of gender, ethnicity, or orientation. While the field has historically been male-dominated, the number of YLs (Young Ladies) and non-binary operators is steadily rising. HAM radio clubs and organizations worldwide are actively working to create welcoming environments where diversity is celebrated. For many, HAMs it is a way to express identity, foster connection, and build confidence.

From the young to the elderly, and from the highly technical to the casual conversationalist, HAM radio has space for everyone. It's a hobby that welcomes curiosity and encourages participation, and its inclusivity strengthens the fabric of this unique community. HAM radio reminds us that, while technology connects us over the airwaves, it's the diversity of people on the other end that truly enriches the experience.

As HAM radio continues to evolve, its blend of technical and social aspects, combined with its inclusivity, ensures that it will remain a beloved hobby for generations to come.

System for Emergency Assistance, Response, and Communication Hub (SEARCH)

by Dr. Pruthviraj U

The lack of a robust monitoring, rescue, and communication hub during disasters can lead to dire outcomes for individuals, communities, and societies. The primary concern is the loss of life, as delayed search and rescue operations can result in avoidable deaths. This issue is exacerbated by delayed medical care, which can lead to long-term health issues or further loss of life post-disaster. Infrastructure damage complicates rescue efforts, impedes assistance provision, and slows down recovery. Without effective search and rescue, population displacement worsens, leaving people stranded and extending their exposure to risk. Moreover, ineffective operations escalate economic costs due to extended recovery periods, infrastructure damage, and reduced productivity. In essence, the lack of a well-equipped emergency hub amplifies the disaster's impact, highlighting the crucial role such systems play in saving lives, reducing damage, and aiding recovery. This is the problem that SEARCH aims to address.

System for Emergency Assistance, Response, and Communication Hub (SEARCH) is created specifically to assist coastal areas of Dakshina Kannada in emergencies or disasters. It is a state-of-the-art rescue and communication centre, designed to enhance disaster response. It is equipped with UHF/VHF/HF radio stations and autonomous aerial and marine vehicles for effective emergency response. It also serves as a learning platform for students and HAM/Amateur Radio enthusiasts, fostering innovation in communication and rescue operations.

SEARCH's uniqueness stems from its ability to go beyond individual components and offer an all-encompassing solution that addresses the complex and dynamic nature of emergency response, and communication. One distinctive feature enhancing SEARCH's adaptability is the incorporation of portable container cabins, equipped with solar panels. These portable units serve as dynamic command centers or remote hubs, ensuring operational flexibility in diverse environments. The integration of solar panels not only aligns with sustainability goals but also ensures continuous functionality, allowing for autonomous and resilient operations, especially in remote or disaster-affected areas. Its versatility,

educational focus, and successful real-world applications contribute to its standing as a pioneering initiative in the realm of technology for national importance.
The SEARCH System has achieved Technology Readiness Level 6 (TRL 6), demonstrating its effectiveness to key stakeholders like the New Mangalore Port Authority (NMPA), the Karnataka Forest Department, factories in Special Economic Zones (SEZ), Mangalore Refinery and Petrochemicals Limited (MRPL), and district administrators in Udupi and Mangalore. Its versatility is evident in its adaptability to various operational contexts, including maritime monitoring, forest monitoring, industrial safety, and critical infrastructure settings. The system's integration of bathymetry surveys further emphasises its commitment to informed decision-making in coastal and marine safety. It's also a learning platform for students and HAM/Amateur Radio enthusiasts, promoting innovation in communication and rescue operations. This multi-faceted approach validates the system's maturity at TRL 6.The Amateur Radio facility operates with strong support and active engagement from MARC (Mangalore Amateur Radio Club)

Relevance of the product/solution in India and total addressable market: SEARCH, distinguished by its advanced marine and coastal monitoring capabilities, autonomous aerial and marine vehicles, and robust communication systems, emerges as a uniquely equipped solution to address a spectrum of emergencies, including cyclones, floods, and industrial accidents. The system's emphasis on search and rescue aligns seamlessly with India's need for swift and coordinated crisis responses, potentially saving lives in critical situations. Moreover, by incorporating portable cabins, SEARCH enhances its operational versatility, ensuring a rapid and flexible response to emergencies. Beyond its functional role, it serves as a valuable platform for technological exploration and education, contributing to India's goal of fostering innovation and expertise in crucial domains. In doing so, SEARCH actively contributes to strengthening the country's overall resilience and preparedness.

Competing products/Technology: SEARCH is an innovative initiative that unifies key elements like search and rescue operations, autonomous vehicles, advanced communication systems, and education into one platform. While there are products that cater to individual aspects of what SEARCH offers, it's the integration of these features that sets it apart. SEARCH not only provides a comprehensive solution for emergency assistance and response but also serves as a valuable educational and operational tool. Its unique approach underscores its innovation in the realm of search and rescue technology.

Prototype details

Control and Command Center: The heart of SEARCH is its Control and Command Center housed in portable container cabins. These cabins, equipped with essential amenities like toilets, cafeterias, and mini-workshops, provide a comfortable and self-sufficient environment for operators. Located at NITK, the command center serves as the nerve center where operators manage and monitor autonomous vehicles and communication systems. This setup enhances operational flexibility, allowing for rapid deployment in various scenarios.

Autonomous Aerial and Marine Vehicles:

Utilising quad rotors and multi-rotors for precision surveys, SEARCH employs advanced aerial platforms for detailed coastal assessments. The Semi-Autonomous Research Vessel (SARV) and Unmanned Surface Vessels enhance maritime monitoring, enabling efficient data collection and search and rescue operations.

Communication Infrastructure: SEARCH's robust communication network includes the HEX, Spider, and tribander Antennas. These components ensure seamless and reliable communication, facilitating real-time coordination between the autonomous vehicles and the command center.

Societal impact: The societal impact of SEARCH is far-reaching, encompassing enhanced emergency response capabilities, increased safety along the coast, and the development of expertise that can be applied in addressing national-level challenges. In essence, SEARCH exemplifies the synergy between educational institutions, industry, and societal needs, illustrating the potential for academia to play a pivotal role in fostering innovation, preparedness, and positive societal change.

Is HF Band Dead? An Indian Amateur Radio Operator's Journey Across the Ionosphere

by Sandipan Basu Mallick (VU3JXD)

It's 5:45 a.m. in a quiet corner of suburban Kolkata. A man in his 60s adjusts the volume knob of his transceiver, and a soft, rhythmic hiss greets him. The hum of his linear power supply is the only other sound in the room. Coffee in hand, he tunes across the 20-meter band with the precision of a violinist drawing his bow—carefully, deliberately.

Then—there it is—a faint voice crackling from halfway across the globe. The man leans in, heart pacing slightly. The game is on. The world is awake.

The Golden Frequency: Echoes of the Past

Before streaming, before instant messaging, and before the world fit into our smartphones, there was HF—the High Frequency band spanning 3 to 30 MHz. For decades, it was the open road for wireless adventurers.

During its golden era in India—spanning from the 1970s through the early 2000s—HF wasn't just a band; it was a dimension. From rural Rajasthan to the hills of Shillong, operators would build antennas with bamboo poles, solder their own rigs, and wait patiently for the bands to open like temple doors at dawn.

They would spin the dial and hear voices from Russia, Morse from Brazil, and sometimes even English news relayed from Beijing or Berlin. In remote corners of India, HF was a passport without paper, a connection to a world otherwise unreachable.

It was also more than hobby—it was a tool of resilience. In disasters, HF transmissions helped connect the disconnected. There were operators who, during cyclones and earthquakes, used nothing but car batteries and wire antennas to pass life-saving messages.

Every contact made, every signal received, carried a rush—part science, part magic.

Fading Frequencies: The Whisper Years

But then came the silence.

With the arrival of smartphones, fiber internet, and satellite communications, the mystique of HF started to fade. New Amateur Radio licensees in India increasingly turned to handheld VHF/UHF sets—handy, inexpensive, and ideal for local contacts.

HF transceivers, with their bulky forms and learning curves, gathered dust. On weekdays, the bands seemed deserted. Voices thinned out. Many asked—has the HF band died?

The silence wasn't a void—it was the beginning of a transformation.

The Digital Dawn: Signals in the Static

In truth, HF wasn't dying. It was evolving.

Amidst the static, new signals emerged. Strange, robotic tones—barely audible—began to fill the gaps left by analog speech. These were digital modes: FT8, JS8Call, PSK31, Olivia, and others.

They didn't sound human. They weren't meant to. They were engineered for low power, low signal-to-noise environments—perfect for India's urban hams grappling with apartment living and electrical interference.

With as little as 10 watts and a makeshift wire antenna, Indian operators started logging contacts from Alaska to Argentina. Software like WSJT-X allowed them to decode digital signals invisible to the human ear.

It was a new kind of thrill—like deciphering alien code. The screen would light up with call signs, distances, and signal reports. Contacts happened silently, without conversation, yet every "73" sent was a whisper through the ether, a victory against physics.

Was it less personal? Yes. But also—more powerful. **HF Beyond Ham Talk: The Explorer's Playground** And still, HF had more to offer.

For those willing to venture off the beaten path, the band was—and is—a frontier. Commercial shortwave broadcasts are still alive: Akashvani formerly All India Radio continues its external services, while stations from Vietnam, South Korea, China, and the Middle East reach Indian shores every night.

More elusive are the time signal stations like WWV (USA) and RWM (Russia), offering precise time and frequency standards. Even more cryptic are weather stations, aeronautical broadcasts, military beacons, and utility transmissions scattered across the HF spectrum.

A curious operator with a patient ear and an SDR interface can decode SYNOP weather data, track aircraft messages over the ocean, or even listen to VOLMET aviation weather briefings.

This is not casual listening—it's detective work. It's the closest one can come to global espionage without ever crossing a legal line.

For those hams in India who live in high-RFI environments, these non-ham HF pursuits offer exciting challenges: decoding the undecodable, chasing rare beacons, logging the unheard.

HF in India Today: A Quiet Rebellion

While the larger perception may be one of decline, the truth on the ground is different. HF in India is not dead—it's quietly, steadily gaining momentum.

A new generation of hams is discovering QRP (low power) HF operations using compact rigs like the Xiegu G90 or homemade BITX transceivers. Clubs are hosting workshops on digital modes. YouTube is alive with Indian ham channels showing FT8 contacts from home-built dipoles.

Even high school students in Nagpur and Shillong are experimenting with Raspberry Pi-based HF digital stations, learning to decode Weak Signal Propagation Reports (WSPR) and log global reception footprints.

The solar cycle, too, is turning. With sunspot activity on the rise, the HF bands—especially 10 and 15 meters—are beginning to sparkle again. Weekends now hum with contest activity, and casual DX is back on the table.

In this backdrop, Indian amateur radio is not retreating—it's recalibrating.

Tomorrow's HF: Survival, Science, and Storytelling

So, what does the future hold?

HF's role has changed. It is no longer the primary voice of ham radio—but it remains its most resilient one. In emergencies, HF doesn't need cell towers or internet—just electrons and atmosphere. This alone gives it enduring value.

At the same time, HF is also a scientific instrument. Operators use it to study ionospheric conditions, propagation paths, and space weather effects. With the right tools, even school students can conduct real-time propagation experiments across continents.

And finally—HF remains a storytelling medium. Every contact, whether digital or voice, is a micro-story. A signal from Siberia. A greeting from South Africa. A weather bulletin from Tokyo. A time pulse from Fort Collins.

It's a living narrative, told through the ether.

Epilogue: A Signal in the Static

Back in Kolkata, the man in his 60s finishes logging the contact—Romania, 20 meters, SSB, good copy.

He leans back in his chair, takes another sip of coffee, and smiles. Outside, the city stirs to life—buses honk, alarms buzz, phones ring.

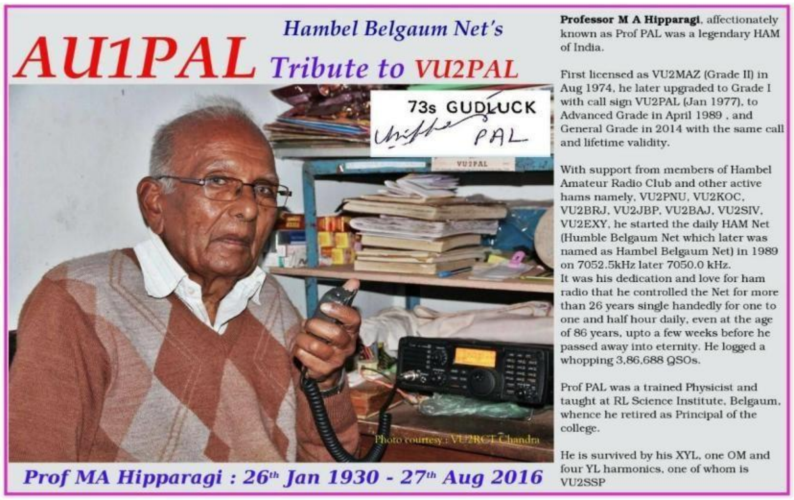
But here, inside his modest shack, something deeper stirs—the thrill of the chase, the joy of discovery, the romance of reaching across oceans with nothing but wire, willpower, and waves.

The HF band isn't dead.

You just have to know where—and how—to listen

History of Hambel Amateur Radio Club & Hambel Belgaum Net.

Compiled by: VU2KOC & VU2BRJ



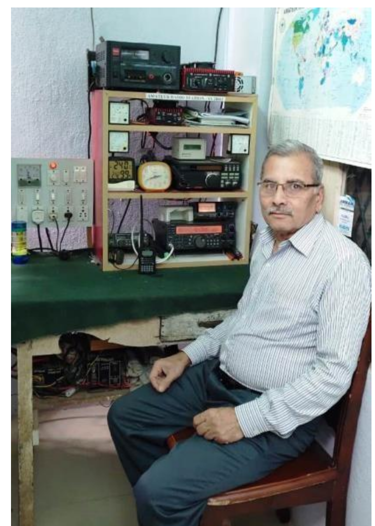
During late 1960s and early 1970s, VU2NSD – Dilip Nerlikar; VU2PAL – Prof. Pal (Prof. M.A. Hipparagi), VU2CKR – Gaddi; VU2ASK – A.S.Kuragunal; VU2SIV (SK) – S.B.Arabhavi and few others interested in HAM Radio, were preparing for ASOC Examination at Belgaum. Finding the required information relating to HAM Radio was difficult in those days. As a result, this small group used to periodically share the available information they could procure, by getting together on every Sunday in the Physics Laboratory of R.L.Science College, Belgaum, wherein VU2PAL was serving as Professor. Moreover, owning a telephone at home was a dream-like privilege for middle class in those days. This periodical get-together on every Sunday morning over a cup of tea, led to formation of Hambel Amateur Radio Club, Belgaum (HARC) in the year 1973 by the founding members VU2NSD – Dilip Nerlikar (licensed in 1973); VU2PAL – Prof. Pal (licensed in 1974 with Grade II call sign VU2MAZ and subsequently upgraded to Grade I & Advance Grade with call sign VU2PAL); VU2CKR – Gaddi; VU2ASK – A.S.Kuragunal and VU2SIV (SK) – S.B.Arabhavi. VU2CKR – Gaddi, who was working in Telegraphs Department, provided CW training regularly.

In 1974 a few others viz., VU2KOC – Omprakash; VU2DLP – Dalpat; VU2PNU – Bebu; VU2MRM – Mohan Metri; VU2JBP (SK) – Jayant Patil; VU2BAJ (SK) – Baji Kaka; VU2TFS – Theodore Fernandez; VU2KDZ – Kumar Shah and others joined HARC and regularly attended the weekly meeting held on every Sunday at R.L.Science College, Belgaum, discussing HAM related matters, more particularly the programme Dx Juke Box & popular Media Net Work Broadcast on Radio Netherlands and VU2PAL also started imparting CW training. Even Kolhapur Group consisting of VU2ABA – Aba; VU2SMN – Suhas and VU2AVG – Avinash (SK) actively participated in the HARC Meeting on Sundays. It is worthwhile to place on record that VU2KOC was the first and foremost to take up ASOC examination in Hindi language which is unique. That apart, VU2KOC & VU2PNU were the first to procure commercial HF Transceiver (Icom IC-751) in 1982 followed by others at Belgaum.

During early 1980s a few more joined as members of HARC viz., VU2SMS – Manju; VU2ACK – Ashok; VU2BRT – Balu; VU2BRJ – Joshi; VU2EXY – Sarvade; VU2SGD – Dr.Sumant Goel; VU2BRG – YL Dr.Beena Goel; VU2SSP – YL Dr.Sukhada (YL Harmonic of VU2PAL); VU3EYE – Dr.S.G.Patil; VU2MAK – YL Maki Kapadia; VU3TYG – Nitin; VU3MUG – Ishwar Rao; VU2BGZ – Bharat Garagatti; Rajmane; and others including SWL Wagh; Bhujannavar and few other inactive Hams whose names are not included here. Cyclostyled News Letter containing Ham related topics and activities of the club were circulated every month to all the members of HARC. VU2EXY – Sarvade (Astronomical enthusiast) played a prominent role in establishing Amateur Radio Station at Science Centre, Belgaum under Advanced Digital Communication Network Project, supported by Dept. of Information Technology, Govt. of India, implemented by National Institute of Amateur Radio, Hyderabad in 2011.

Omprakash, VU2KOC

Outing, Hiking, Trekking & Field Day to nearby places with VHF Handy were organised from time to time with active participation of all the members of HARC apart from Astronomical observations arranged by VU2JBP – Jayant Patil and VU2EXY – Sarvade. Erection of Antenna at the QTH of other Hams was gracefully taken up by the members of the club. VU2ABA (SK) & VU2BGZ – Bharat Garagatti (SK) provided much needed technical support for home-brewers of the Club. Amateur Radio Club, Shimoga, with its active members viz., VU2SLJ (SK) – Jois; VU2BCP (SK) – Patil; VU2VSJ – Prasanna; VU2LAU – Laxman provided Home-brewed 40 Mts. SSB Rx & QRP Tx built and developed by VU2SLJ (SK) – Jois to some of the members of HARC. VU2MRM is a feather in the cap of HARC in the matter of CW contacts. In 1990s during any local road traffic accident and such other exigencies, the members of HARC provided possible assistance to the local police for which the then SP of Belgaum had also issued ID cards to the members of HARC captioned "HAMS IN PUBLIC SERVICE". Amateur Radio Club of Kolhapur & Belgaum jointly provided vital VHF communication for MASA (Maharashtra Automotive Sports Association) Car Rallies during late 1980s & early 1990s, besides providing communication backup in 1990s during Elections, at the request of DC, Shimoga.



Joshi - VU2BRJ

<u>**History of Hambel Belgaum Net**</u> : When VU2BRJ – Joshi got his licence in June 1988, he started using a QQRP Crystal Transmitter consisting of single SL100 Transistor with PEP between 500 milli-watt to 1 watt which was assembled by VU2KOC in a plastic soap box (same is preserved as an antique piece till today). The said QQRP's Crystal frequency was 7052.50 kHz. At the request of VU2BRJ, the local hams at Belgaum used to have regular QSOs with him between 7.00 a.m. and 8.00 a.m. on 7052.50 kHz, and VU3BUT – Dr. B.U.Tekani from Bhavnagar (Gujarat) was Dx-like thrilling station for VU2BRJ to get 599 report on the said Crystal QQRP. As days rolled by, other outstation Hams also started joining the group on 7052.50 kHz between 7.00 a.m. and 8.00 a.m. Thus, VU2PAL – Prof. Pal started the Belgaum Net in November 1989 and later on named it as HAMBEL Belgaum Net and shifted the operating freq. from 7052.50 kHz to 7050 kHz. VU2PAL – Prof. Pal untiringly

conducted the Hambel Belgaum Net with all dedication till a week prior to his death on 27.08.2016 and thereby logged whopping 3,86,688 QSOs.

Prof. Pal, VU2PAL (centre) with other hams at a Ham Radio Workshop conducted by HARC, Belgaum in conjunction with National Institute of Amateur Radio.

Manju - VU2SMS

Hambel Belgaum Net is still continued with the same fervour, zeal, enthusiasm and dedication daily on 7050 kHz from 7.00 am to 9.00 IST by six Net Controllers viz., VU2PNU – Bebu; VU2ACK – Ashok; VU2SMS – Manju; VU2KOC – Omprakash; VU2BRJ – Joshi & VU3XFH – Mahantesh. VU2ZMK – Mahindra from Ponda, Goa is untiringly providing Live Stream of Hambel Belgaum Net on YouTube w.e.f 12.02.2023.

Every year on 27th August, Hambel Belgaum Net is dedicated in memory of Prof. Pal. In 2017 Special Call sign AU1PAL was procured on his first death anniversary and QSL card on the occasion was designed, printed and supplied by VU3BUT – Dr.Tekani; VU2SPF – Prof. S.P.Bhatnagar and team members of Bhavnagar Amateur Radio Club, followed by Indian Institute of Hams, Bengaluru, on the second death anniversary of Prof. Pal in 2018.The future plan of HARC is to install a VHF Repeater at Belgaum.

Hambel Belgaum Net

is conducted daily from
7.00 to 9.00 am IST on 7050 kHz. Net Controllers:
VU2PNU : Bebu.
VU2ACK : Ashok. VU2SMS : Manju. VU2KOC : Omprakash.
VU2BRJ : Joshi.
VU3XFH : Mahantesh.

Please Check into Belgaum Net & Other Nets:

a) To mark your presence on Air.
b) To Check Propagation condition.
c) To Check for Friends / Ham Activity
d) To pass on any messages
e) To Check performance of your Antennas / Rig.

73 from Hambel Amateur Radio Club (HARC), Belagavi, Karnataka !

Tracking the International Space Station (ISS)

by C. Demastan (VU3DMT)

The International Space Station (ISS) is a large space station that was assembled and is maintained in low Earth orbit by a collaboration of five space agencies and their contractors: NASA (United States), Roscosmos (Russia), ESA (Europe), JAXA (Japan), and CSA (Canada). The ISS is the largest space station ever built. Its primary purpose is to perform microgravity and space environment experiments. The ISS provides a platform to conduct scientific research, with power, data, cooling, and crew available to support experiments.

Amateur Radio on the International Space Station (ARISS)

Amateur Radio on the International Space Station (ARISS) is a program that facilitates radio communications between licensed Amateur Radio operators and crew members aboard the International Space Station using the amateur-satellite service. Students and Amateur Radio operators all over the world are able to speak directly to astronauts and cosmonauts via handheld, mobile, or home radio stations. Low power radios and small antennas can be used to establish communications.

How to hear the ISS

Almost any 144 MHz FM rig will receive the ISS, you can even use a general coverage VHF scanner with an external antenna. As far as the antenna is concerned the simpler the better. A ¼ wave ground plane has a high angle of radiation and works well. Large 144 MHz colinears are not as good because the radiation pattern is concentrated at the horizon while the ISS is above 15 degrees elevation for most of a pass. The ISS puts out a strong signal on 145.800 MHz FM and a 2m handheld with a 1/4 wave antenna will be enough to receive it.

Listening Online

If you don't have an Amateur Radio receiver you can still listen to the ISS by using an Online Radio, also known as a WebSDR. Select a Frequency of 145800.0 kHz and Mode FM:

- Farnham WebSDR when ISS is in range of London http://farnham-sdr.com/
- R4UAB WebSDR when ISS is over Russia http://websdr.r4uab.ru/

Check the N2YO site to see when the ISS is in range https://n2yo.com/?s=25544&df=1

Tracking Software

In my experience ISS Detector is very useful. It can be downloaded from the Google store. This app gave me accurate information on where to look to acquire the station so I was able to watch it pass across the sky. The ISS travels at great speed. The moment that ISS gives me a notification, it will be visible from my location in 5 minutes before. The object called Tiangong is the Chinese space station. It is also visible. With ISS Detector, you can easily track and locate the ISS using just your smartphone.

Ham radio in ISS

The Kenwood TM-D710GA radio is located in the ISS Columbus Module, supports 2 meter (144-146 MHz) and 70 cm (435-438 MHz) operation. This radio provides a higher output power capability (restricted to a maximum of 25 Watts in ISS operation) supporting FM and packet operations. There is one radio on the ISS that operates as a packet Digipeater. The Columbus D710GA can support those operation at about 10 watts and uses NA1SS. It will respond to the alias "ARISS".

Repeater

A cross band FM Amateur Radio repeater with a downlink on 437.800 MHz was activated on the International Space Station. This high speed makes radio signals appear to shift in frequency, a phenomenon called Doppler Shift. This Doppler shift will cause the ISS transmit frequency of 145.990 MHz to look as if it is 3.5 kHz higher in frequency, when ISS is approaching your location. The ARISS cross-band repeater uplink is 145.990 MHz (67 Hz tone), with a downlink of 437.800 MHz. A duel band antenna is ideal to make contacts.

Slow Scan Television (SSTV)

The most exciting experience related to ISS is to receive SSTV images. Slow-scan television (SSTV) is a picture transmission method, used mainly by Amateur Radio operators, to transmit and receive static pictures via radio in monochrome or colour. SSTV was used to transmit images of the far side of the Moon from Luna. Slow Scan Television (SSTV) is transmitted by the ARISS Russia Team from the Amateur Radio station in the Russian Service Module of the International Space Station using the call sign RS0ISS. The equipment used is a Kenwood D710 transceiver running about 25 watts output which provides a very strong signal enabling reception using simple equipment. In the past twelve different images were sent on 145.800 MHz FM using the SSTV mode PD180, with a 3-minute off time between each image. This has now changed to use the faster PD120 mode with a 2 minute off-time which will allow more images to be received in an orbital pass. Rubber ducky antenna is enough for this.

How to download SSTV image

I am using ‘Robot36’ the SSTV Image Decoder for downloading ISS SSTV images via smart phone. It can be downloaded from the play store. The support mode is PD 120. On detection of the calibration header of a supported mode, the resulting image will be automatically saved to the "Pictures" directory and can be seen in the Image gallery.

Apply for an Award

ISS contacts are incredibly rare, so sometimes people fill out that form for ARRIS contacts through the ISS Digipeater, and they get a nice card sent to them. Send your decoded images to ARISS in the “Expedition 73 – ARISS Series 27” area and apply for an award at the following address by online.

https://ariss-usa.org/ARISS_SSTV/ https://www.bsattrac.com/arissmai-sstv-event

QSL Cards

ISS contacts are incredibly rare, so sometimes people fill out that form for APRS contacts through the ISS digipeater, and they get a nice card sent to them. The address will publish time to time. Online submission of images is possible.

New Callsign prefixes for Radio Amateurs in India

by Jose Jacob, VU2JOS

With effect from 25 June 2025, callsigns with new prefixes are being issued to new Radio amateurs in India as follows:

- General Grade: VU21-VU29 series followed by 2 letter suffixes
  - Restricted Grade: VU31-VU39 series followed by 2 letter suffixes OM Sandy VU22DX of Goa was the very first one to report receipt of his new callsign (ex VU3FGJ) with the brand new prefix! Other new prefixes issued recently like callsigns like VU24DX, VU25AK, VU26CT, VU27YN, VU29AR, VU32VV, VU33IG, VU36VS, VU37JD, VU38AP and similar combinations represent a new scheme for issuing callsigns to amateur radio operators in India. Here's the background:

Traditional Indian Prefixes: For a long time, Indian Amateur Radio operators were primarily issued callsigns beginning with VU2 for General (formerly Advanced and Grade-I) license holders and VU3 for Restricted (formerly Grade-II and Grade-II Restricted) license holders. These were typically followed by two or three alphabets (e.g., VU2TO, VU3LMS).

Need for Expansion: As the number of licensed Amateur Radio operators in India has grown, the pool of available traditional callsign combinations starting with VU2 and VU3 followed by alphabets likely began to dwindle.

New Numbered Prefixes: To address this, the Wireless Planning and Coordination (WPC) Wing of DOT, Ministry of Communications, which is responsible for issuing Amateur Radio licenses in India, has introduced these new numbering schemes.

VU21.. to VU29.: prefixes followed by 2 alphabets. These are now being issued for new General Grade licenses.

VU31.. to VU39.. prefixes followed by 2 alphabets. These are now being issued for new Restricted Grade licenses.

International Context: Amateur radio callsigns are regulated internationally by the International Telecommunication Union (ITU). Each country is assigned blocks of prefixes. India's assigned prefix blocks are ATA-AWZ, VTA-VWZ, 8TA-8YZ. While the ITU assigns these broader blocks, the national licencing authority in India viz Wireless Planning & Coordination Wing determines the specific structure and sequence of callsigns within those blocks. The addition of numbers after the initial "VU" and a single digit (like VU2 and VU3) is a method to create more unique identifiers.

It is reported that Echolink and LOTW are having problems to accommodate these new prefixes!

Continuation of Old Callsigns: Existing callsigns starting with VU2 and VU3 (followed by alphabets) will continue to be valid. The new system applies to newly issued licenses.

In essence, these new prefixes are a practical measure to accommodate the increasing number of amateur radio enthusiasts in India by expanding the available callsign combinations while still adhering to the country's internationally allocated prefix block (VU).

The list of such new callsigns compiled me (which will be updated regularly) is available in https://qsl.net/vu2jos/New_Calls.htm

Goa Radio Amateurs Society (GRAS)

by Amey Pandit (VU2YQ)

The Goa Radio Amateurs Society (GRAS) was established in the late 1960s, marking the formal organisation of HAM radio enthusiasts in the region. Founded under the initiative of Sulu / VU2GV, with C. E. Albuquerque serving as its first president, GRAS quickly became a central hub for amateur radio activities in Goa. Venkatesh Angle / VU2WA, from the P & T Department, played a pivotal role in introducing new programmes and nurturing the local HAM community. His contributions were significant in ensuring that GRAS remained active and influential in the early years. GRAS expanded its presence by establishing branches in Vasco, Margao, and Panaji, where monthly meetings, Morse code classes, and discussions on equipment were held. This period laid the foundation for a thriving ham radio community in Goa.

In the 2000s, VU2SMS (Manjunath Shinde) and VU2ROE (Ronald Rodrigues) were vital in keeping GRAS vibrant, organising various activities and special activations. Notable events included the Grandi Island activation in 2009, in collaboration with the National Institute of Amateur Radio (NIAR), and the special operation during the Lusofonia Games in 2014. These activities showcased GRAS's commitment to technical excellence and community service. A significant milestone in GRAS's history was its formal registration as an official Society in 2024. The founding members were:

1. Mahendra Kannavar (VU2ZMK) – Founding Member and President
2. Sandesh Bhat (VU3FGJ) – Founding Member and Secretary
3. Amey Pandit (VU2YQ) – Founding Member and Treasurer
4. Ronald Rodrigues (VU2ROE) – Founding Member
5. Ranjan Chakrabarty (VU2APU) – Founding Member
6. Vaishabh Jalmi (VU3IAG) – Founding Member
7. Vishal Naik (VU2TDT) – Founding Member
8. Carmelito Andrade (VU2FUD) – Founding Member

Their intention in formalising GRAS was to create a structured and sustainable framework for HAM radio operations in Goa, ensuring the society's longevity and ability to serve the Amateur Radio Community effectively. In recent years, GRAS has conducted various events in Goa, such as International Lighthouse and Lightships Weekends across various Lighthouses in and around Goa, ARSI Field Day contest and HAM radio sessions in various colleges and institutions in Goa.

Helping Each Other Grow: Peer Mentorship in Amateur Radio

by Sivarama Prasaad Veluri (VU2ICC)

When I first tuned into the world of Amateur Radio, I had more excitement than experience. I knew the basics, what a transceiver was and roughly how an antenna worked, but the real magic of making my first proper contact felt far out of reach.

That changed when I met Shri Suri, VU2MY. He didn't just point me to the right equipment or explain how to connect a feedline. He took the time to sit with me, talk about the hobby, and help me feel like I was part of something bigger. It wasn't just about the technical steps, it was about belonging.

In Amateur Radio circles, we have a word for that kind of guidance: "Elmering". It's an old tradition, an experienced operator taking someone new under their wing, passing along not just skills but the spirit of the hobby. Without it, many of us might never get past that difficult first stage where every QSO feels like a test.

Mentorship is what keeps the knowledge flowing from one generation to the next. It's in the quiet moments when someone explains why your SWR is high, or walks you through logging your first contest entry, that the real learning happens. Sometimes it's a quick tip over VHF. Other times it's an afternoon spent soldering together a kit, or a late-night HF session where the mentor hands you the mic and says, "Go ahead, make the call."

Younger operators are finding their own ways to keep the tradition alive. Groups like Youngsters On The Air (YOTA) and Young Amateur Communications Ham Team (YACHT) connect people who are closer in age, making it easier to learn from each other. Locally, even without formal programs, a simple pairing of an eager newcomer with a seasoned operator can make a huge difference.

Nothing beats learning by doing. Field days, Hamfests, and small club meets are perfect for this. You see someone's eyes light up when they make their first contact, or when a tricky antenna finally tunes. These moments can't be taught in a manual; they have to be experienced.

The best mentors share more than just technical skills. They pass on patience, showing how to work through a pile-up without losing your cool. They pass on decorum, when to call and when to listen. And they pass on excitement, that quiet satisfaction when you finally reach a rare DX station or help set up a portable station in the middle of nowhere.

Modern tools make it easier than ever to stay connected. Between HF, VHF, UHF, and platforms like EchoLink, you can keep in touch with a mentor or mentee anywhere in the world. A short message with a tip, a shared photo of a project, or a quick call to help troubleshoot a rig all keep the learning alive.

If you've been in the hobby a while, here's something to think about. Somewhere out there is someone who's just getting started, someone who could use a hand. Invite them to join you for a net. Help them set up their first antenna. Let them take the mic during a contest. It's a small gesture that can turn a newcomer into a lifelong Amateur Radio Operator.

Mentorship is how we pass the torch. It's how we keep the signal strong, not just in the bands we use but in the community we build.

Celebrating the Spirit of HAM: A Personal Tribute to Amateur Radio

By Benny Kuriaksoe (VU2MZN)

As VU2MZN – Benny Kuriaksoe, I write with pride and purpose within a community defined not by boundaries, but by signal strength, solidarity, and selfless service. Amateur Radio has long been more than a hobby—it's a lifeline when all others fail. At its heart lies a simple but powerful ethos: connect, contribute, and communicate.

When calamity strikes and conventional communication crumbles, HAM operators become the unsung heroes. Whether it's coordinating rescue missions during floods, transmitting vital information in remote areas, or simply providing a reassuring voice over the airwaves, we operate with quiet conviction. In moments of chaos, we bring clarity. Looking ahead, the future of emergency communication through amateur radio holds immense promise. From digital modes like Winlink/Echolink and DMR to innovations like mesh networking and solar-powered repeaters, we're entering an era where resilience meets technological brilliance. These advancements not only enhance our capacity to respond but also reaffirm our role in safeguarding lives.

But no future can flourish without fresh voices. It's vital that we inspire the next generation of operators—those who will take up the mic not for glory, but for service. Volunteering as a HAM is a rare calling where passion meets altruism. Every new enthusiast strengthens our network, our reach, and our readiness.

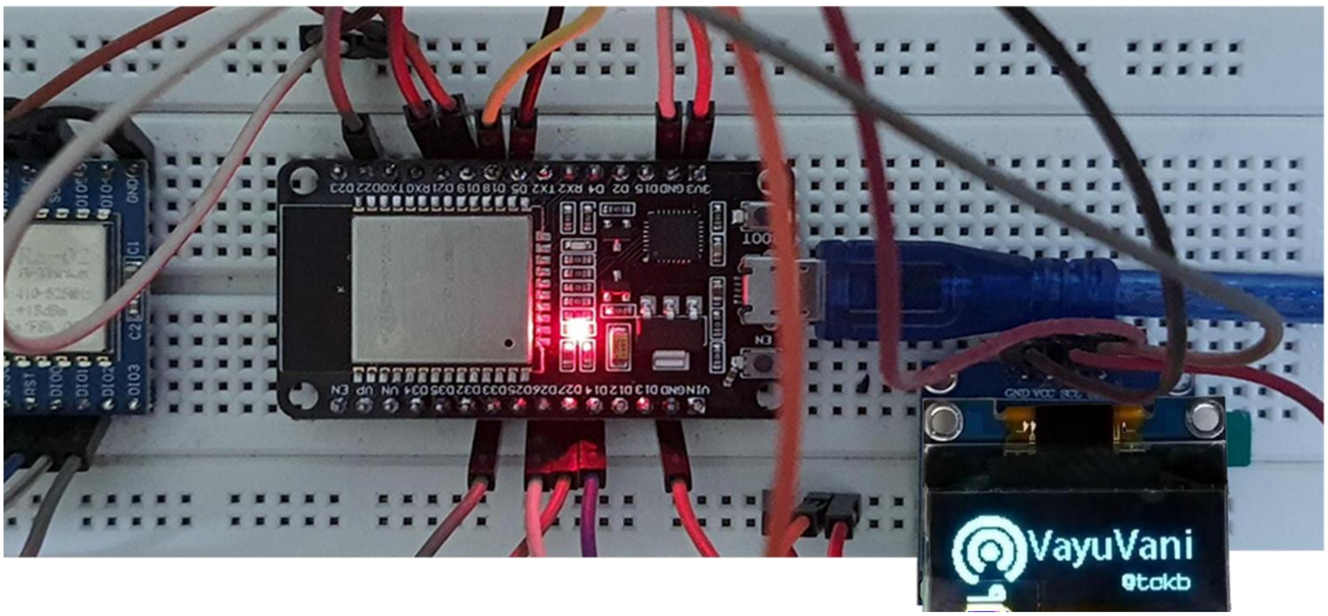
This year, HAM FEST INDIA in Goa is a vibrant celebration of these very values. As we mark the centenary of ham operations, HamFest India 2025, Goa, stands as a premier event uniting Amateur Radio enthusiasts, innovators, and experts from around the world. We are invited to engage in technical sessions, hands-on workshops, and unparalleled networking opportunities designed to celebrate and expand our incredible community. Come, let's explore cutting-edge advancements, collaborate on projects, and enhance our skills in an environment dedicated to learning and innovation. Here's to the frequencies we share, the friendships we forge, and the future we're building together! Kudos to the organisers especially the HAM fraternity of Goa!

VayuVani:

A Self-Managed LoRa Ground Station for Amateur Operators

By K Giridhar Reddy (VU2TIO), Chandra Tungathurthi

Democratizing Amateur Satellite communication while maintaining high standards of privacy and enabling operators' total control – *all under 10 dollars!*



Introduction

In recent years, the field of amateur satellite communications has witnessed a significant advancement with the emergence of LoRa satellite ground stations. These stations leverage Long Range (LoRa) technology to establish reliable connections with satellites in low Earth orbit (LEO), opening up new possibilities for enthusiasts, researchers, and educational institutions. Among these innovative systems, VayuVani stands out as a solution that prioritizes user privacy and autonomous operation.

The centralized nature of traditional networks exposes several operational weaknesses and typically operate under a centralized model:

- **Network-Centric Operation**: Stations are interconnected, sharing data across multiple nodes.
- **Central Authority**: A single entity or a small group controls the entire network.
- **Mandatory Data Sharing**: Users are often required to share all collected data with the network.

In this evolving landscape, VayuVani emerges as a direct response to the frustratingly restrictive nature of traditional amateur satellite communications. While existing ground station networks trumpet the benefits of collaboration through shared data networks, the reality is far more constraining.

VayuVani deliberately breaks away from this restrictive model by offering complete user autonomy. Instead of forcing users to operate within the confines of a central authority's vision, it enables truly offline functionality and absolute local control. The system recognizes that true innovation in amateur satellite communications can only flourish when users have complete control over their ground stations, free from the bureaucratic overhead that plagues traditional networks.

Technical Specifications

LoRa Technology

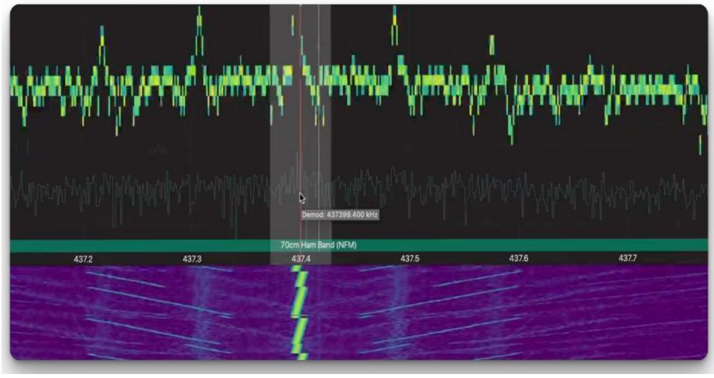


Fig 1: LoRa Chirp Signal Capture in 70cm Amateur Band - Waterfall and Time Domain Display (437.399 MHz)

VayuVani utilizes LoRa (Long Range) technology as the foundation of its communication capabilities. The system employs Semtech SX127x or SX126x chips, operating in the Industrial, Scientific, and Medical (ISM) frequency bands, specifically 433 MHz or 868 MHz depending on regional regulations. These chips implement LoRa's chirp spread spectrum (CSS) modulation, which provides excellent resistance to interference and multipath fading effects.

The system supports configurable LoRa parameters to optimize satellite communication:

- Spreading Factors (SF) ranging from SF7 to SF12, allowing trade-offs between data rate and range
- Bandwidth options of 125 kHz, 250 kHz, and 500 kHz
- Programmable preamble length for reliable signal detection
- Configurable coding rates (4/5 to 4/8) for forward error correction

For satellite communications, VayuVani typically operates with:

- Higher spreading factors (SF10-SF12) to maximize reception sensitivity
- Optimized preamble lengths to account for Doppler shift
- Adaptive bandwidth settings based on specific satellite requirements

Figure 1 clearly shows the characteristic diagonal lines in the waterfall plot that are typical of LoRa's chirp spread spectrum modulation, where the signal frequency sweeps across the bandwidth. The bright yellow-green trace indicates a strong signal reception, and the diagonal pattern is distinctive of LoRa's frequency-shifting chirp modulation technique.

Antenna System

The antenna system plays a pivotal role in VayuVani's performance. Most setups employ directional antennas or specialized designs optimized for satellite communication. These antennas are crucial for:

- Maximizing signal reception from satellites.
- Minimizing interference from terrestrial sources.
- Enhancing the overall efficiency of the communication link.

The choice and proper installation of the antenna system significantly impact the quality and reliability of satellite communications. Based on the purpose, various antennas can be employed.

A few of the most commonly used antennas are :

Dipole antenna V Dipole antenna

Fig 2: Home made Antennas (1)

Dipole Antenna:

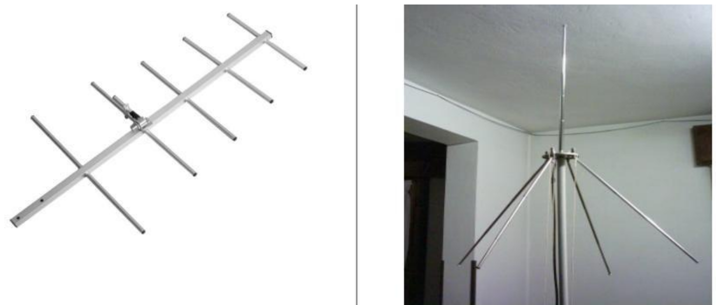
This is a simple and efficient antenna often used for its ease of construction

and good performance. It's great for general communication needs in LoRa setups.

V Dipole Antenna (Rabbit Ear Antenna):

This antenna is similar to the dipole but arranged in a "V" shape. It can provide better directional gain, making it useful for targeting specific areas.

Fig 3: Home made Antennas (2)



Yagi Uda Antenna ¼ wave Ground Plane antenna

Ground Plane Antenna:

This antenna uses a central radiating element and radial elements (ground plane) to provide good omnidirectional coverage, which is ideal for widespread LoRa communications.

Yagi Uda Antenna:

Known for its high gain and directional properties, the Yagi antenna is useful for long-distance communication links where directionality and gain are crucial.

The above antennas can easily be homebrewed. As the most commonly used LoRa board operates at a frequency of 433 MHz, the antenna is smaller in size and doesn't require much material to prepare. All the above antennas are tested and reviewed, and the choice of the antenna is left up to the Vayuvani ground station owner or host.

Privacy and Autonomy Features in VayuVani

One of VayuVani's most distinctive features is its approach to privacy and user autonomy. As explained in previous sections, VayuVani enables completely offline functionality while maintaining local operational control. VayuVani's architecture ensures this through three critical design principles:

Operationally disconnected

User-Centric Control Architecture

Data Sovereignty

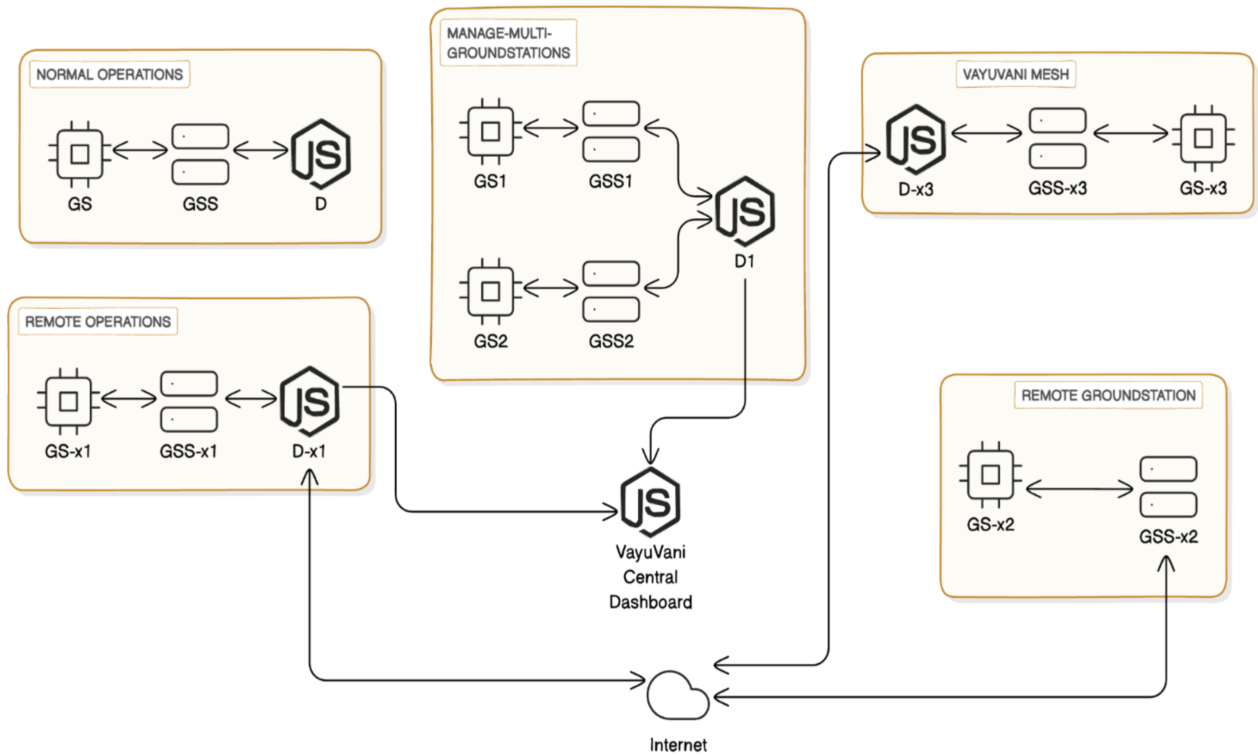


Fig 4: Various Topologies in VayuVani

Operationally disconnected

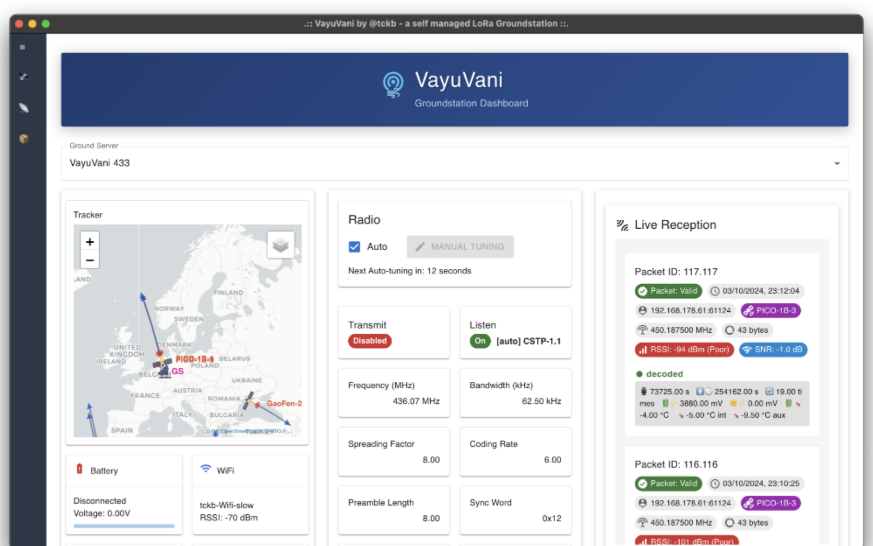


Fig 5: VayuVani Dashboard showing real-time satellite tracking and LoRa configuration (436.07 MHz) with PICO-1B-3 telemetry reception. Auto-tuning mode enabled waiting to capture packets of CSTP-1.1

The system operates completely independently of internet connectivity, ensuring all data remains strictly local. This isn't meant as a fallback feature - it's the *core design principle* that ensures complete data sovereignty. The ground station processes all satellite signals locally, performs decoding operations on-device, and stores data without any external dependencies. This approach eliminates potential security vulnerabilities associated with network transmission and prevents unauthorized access to sensitive communications.

User-Centric Control Architecture

VayuVani fundamentally reimagines ground station control by placing complete operational authority in the users' hands. This comprehensive control manifests across multiple aspects of the system's operation. At the RF level, users exercise complete authority over their radio parameters. This includes precise control of frequency selection across supported bands, with the ability to fine-tune bandwidth configurations from 62.5 kHz to 500 kHz. The system allows detailed optimization of spreading factors, coding rates, and preamble lengths - all crucial parameters for achieving optimal satellite communication. As shown in the dashboard interface, users can adjust these parameters in real-time, with settings like SF8.00 and coding rate 6.00 being typical for LEO satellite reception.

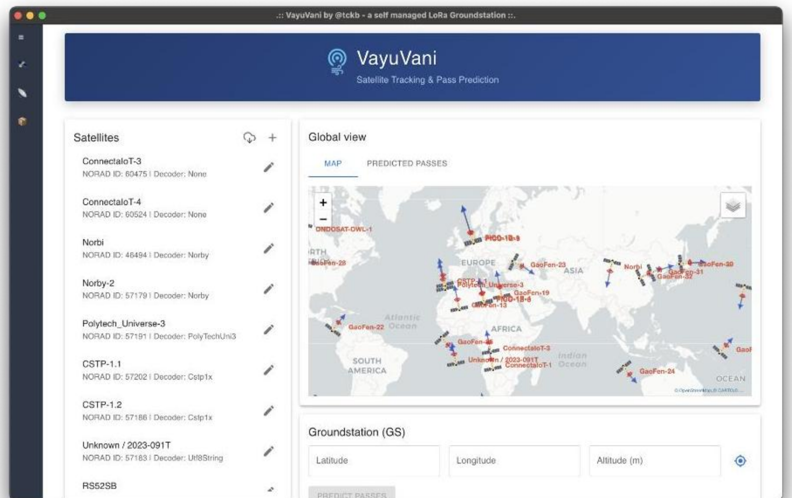


Fig 5: VayuVani Dashboard showing real-time satellite tracking screen, currently showing the available satellites. The 'Predicted Passes' of the selected satellite shows the passes over the current location.

Data Sovereignty

VayuVani fundamentally reimagines data handling in satellite communications through its real-time, locally-controlled architecture. Unlike networked systems that mandate central control, VayuVani operates as a truly independent entity, establishing a direct, secure pipeline from signal reception to analysis. When the ground station receives signals from a tracked satellite, the raw data is transmitted in *realtime* to the ground station application. This real-time transmission ensures that higher data reception rates are possible because of the lack of *any* further processing on the ground station itself.

The application which receives only raw packet data then performs local decoding operations, transforming raw satellite signals into decoded packet data - all without touching the internet or external services. The decoded data is further processed into human readable data.

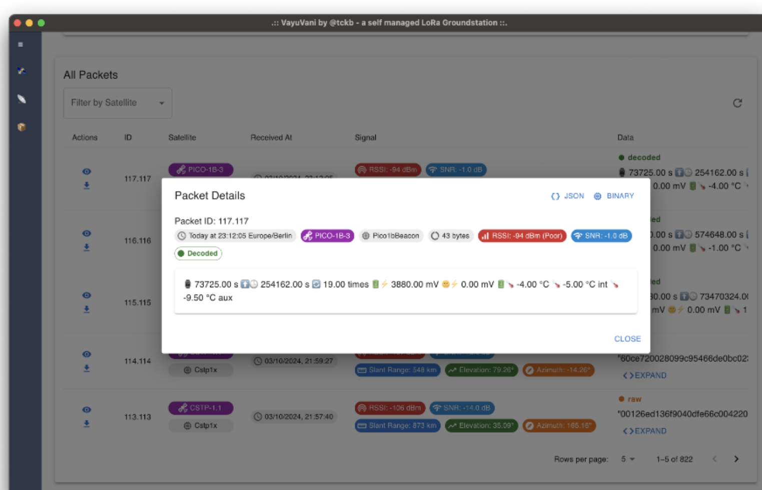


Fig 6: VayuVani Dashboard showing the analytics of currently tracked packets. A tracked packet shows both decoded as well as raw packet.

Affordability Meets Scalability

One of the key advantages of VayuVani is its accessibility and affordability. The system's modular architecture and emphasis on customization enables the creation of ground stations for as little as ₹900, making space communication accessible to virtually anyone.

The basic VayuVani ground station can be assembled using readily available components:

The simple Complete Ground station Setup can be made under INR 900/- which is ultra-Affordable.

This ultra-affordable entry point is particularly significant for:

• Students in emerging economies like India
• Educational institutions with limited resources
• Individual experimenters and hobbyists
• Small research groups and startups

S.No.	Component Name	Approximate costs
1	ESP 32 (ESP WROOM 32)	INR 250
2	LoRa SX 1278 (Ra-02 433MHz)	INR 350
3	0.96" OLED display	INR 100
4	Complete Antenna	INR 200
5	TOTAL	INR 900

Some Applications Benefiting from VayuVani's Design

This unique approach particularly benefits applications requiring private communication channels and independent operation capabilities, such as:

Applications of VayuVani:

STEM Education
Schools and universities can build ultra-low-cost ground stations, enabling hands-on satellite communication education without expensive equipment or internet dependency. Students can track real satellites, analyze signal data, and understand space science through practical experience.

Research Independence
Academic labs and independent researchers can conduct satellite studies with complete data sovereignty. The detailed metrics and analysis tools enable thorough research while maintaining full control over data collection and methodology.

Community Science Networks
Local astronomy clubs and hobbyist groups can create independent ground station networks, sharing satellite tracking data within their communities while maintaining operational autonomy. The system's modular design enables collaborative projects without external dependencies.

Remote Monitoring
Research stations in isolated locations can maintain continuous satellite monitoring without requiring constant internet connectivity. The comprehensive dashboard enables detailed analysis of satellite behavior and signal characteristics even in offline scenarios.

The VayuVani Vision

By prioritizing privacy and autonomy, VayuVani not only addresses growing concerns about data security in an increasingly connected world but also opens up new possibilities for satellite communication in sensitive or specialized applications.

This innovative approach demonstrates how modern technology can democratize space communication while respecting user privacy and independence, setting a new standard in the field of amateur satellite communications.

Limitations and Future Directions

While VayuVani represents a significant advancement in amateur satellite communications, it's important to acknowledge its current limitations and potential areas for future development:

Current Limitations

Local Network Dependency: The ground station and dashboard must operate on the same local network to maintain privacy and user control, making remote operations challenging without additional network configuration.

LoRa-Only Reception: Currently limited to satellites using LoRa modulation, preventing reception of other common satellite protocols and limiting the range of accessible satellites.

Future Directions

To address these limitations and further enhance VayuVani's capabilities, several future directions can be explored:

Privacy-Preserving Remote Operations: Developing a secure relay network architecture that enables remote station management while maintaining VayuVani's core principle of user data sovereignty and operational independence.

Community Ground Station Network: Creating a framework for community-operated ground stations, enabling collaborative satellite tracking while ensuring each station maintains complete local control over their data and operations.

Furthermore, future developments will focus on wider protocol support, community education, advanced analytics, and automated management thereafter.

Conclusion

VayuVani represents a fundamental shift in amateur satellite communications, demonstrating that privacy-focused, user-controlled systems are not just possible but practical.

With comprehensive dashboard metrics from signal analysis to packet-level data, and an architecture that provides a foundation for community-driven satellite communications, it enables stations to maintain independence while contributing to the broader community. This ground station architecture, emphasizing user control and data sovereignty, proves that democratizing access to space doesn't require compromising on privacy or capability, making sophisticated satellite communications accessible to students, researchers, and enthusiasts worldwide.

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K. Giridhar Reddy (VU2TIO) is a third-year B.E. student majoring in ECE at CBIT, Hyderabad. Obtained his Ham Radio license just 8 months ago and Fascinated by Amateur radio applications in space, he began working on satellite ground stations that operate using LoRa technology. He and his team at CBIT designed, experimented with, and built LoRa modules and several antennas for this purpose. Currently his team is working on CubeSats and other small homebrewing HAM radio projects.

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Chandra Tungathurthi is an independent researcher and data analyst with a background in Computer Science from JNTU Hyderabad, India. He furthered his research studies in Germany and Japan, gaining international experience. In the past year, Tungathurthi has made significant contributions to lunar exploration, most notably receiving international recognition for locating Japan's SLIM lander on the Moon using data from India's Chandrayaan-2 orbiter. Currently based in Germany, he applies his expertise to help businesses tackle challenges with advanced generative AI solutions.


KENWOOD
TS - 990S
200W HF/50MHz Transceiver
Flagship dual-receiver HF/50MHz transceiver engineered for uncompromising performance and operator prestige.
TS - 890S
100W HF/50MHz Transceiver
High-performance HF/50MHz transceiver combining advanced DSP technology with robust design for serious DXers and con-testers.
ICOM
IC - 7760
Latest Gen Flagship HF/50MHz Transceiver
IC - 7610
Dual-receiver SDR for elite DX
IC - 7300
Compact SDR for everyone
www.rfcharge.com
we specialize in high-performance telecommunication solutions built for critical infrastructure, defence, marine, aviation, and Hamradio R&D sectors.
THE ULTIMATE FIELD GEAR

Father of Wireless Communication - Aacharya Jagadish Chandra Bose.

by Datta Deogaonkar (VU2DSI)

'The Indian Scientist Aacharya J.C.Bose in 1895 transmitted wireless signals to a distance of a mile. Popov in Russia was still trying remote signaling at this time. The wireless experiment by Marconi was not successful till May 1897. The public demonstration by Bose in 1895 predates all others.'

We all Indians are proud of the great scientist Acharya J.C.BOSE for his contribution in the field of electronics & biophysics. Bose's well-known invention was/is transmitting signals with the help of electromagnetic waves without any medium—wirelessly.

Aachatya J.C.Bose was a Professor of physics in the Presidency College at Kolkata in the 1890s. In 1894, J.C.Bose converted in the college, a small enclosure adjoining a bathroom, into a laboratory to carry out his experiments involving refraction, diffraction & polarization of electromagnetic waves. When Bose started his experiments in Presidency College, he trained roadside tin-smiths to make instruments like a horn antenna of metal sheets.

Aacharya J.C.Bose was a polymath, equally well in biophysics. He presented a paper "on the similarity of responses to the external stimulus by inorganic & living matter". To prove his theory, he devised an instrument known as "the crescograph". In the field of botany, his contribution has no parallel in that discipline. Bose, in a public demonstration, showed that the same type of pains, feelings & sensations are created as those of living human beings (creatures) in the plants & also in the non-living things by external stimuli.

Bose was studying the transmission of electromagnetic waves. After successful experimentation in the laboratory, he demonstrated in 1895 at Presidency College, Kolkata, how electromagnetic waves travel without any medium. Bose triggered gunpowder in the third room from his demonstration classroom & rang the 75 feet away bell remotely in the nearby room on the campus of the college. In another experiment, he sent wireless signals over a one-mile distance.

Bose was invited by Lord Rayleigh in 1897 to perform his demonstration of wireless signaling at the Royal Institute in London during a Friday lecture. Bose described his research carried out in millimeter waves in Kolkata in 1895 at the Royal Society of London. He demonstrated his research with wave guides, horn antennas, dielectric lenses, various polarizers & even semiconductors at frequencies as high as 60 GHz.

In the assembly of scientists during his demonstration/lecture, Marconi from Italy was also present. He was also experimenting in the field of electromagnetic waves at that time. Marconi, after the demo, interacted with Bose with great curiosity & inspected the instruments used by Bose. Bose invented 1898 the Mercury Coherer with a telephone detector & unveiled this invention in a paper at the Royal Society.

Bose lost his diary with all details, mysteriously, after some days. Bose made a device 'coherer," which transmitted & received radio waves. In this device, he used a mercury tube & telephone. In 1899 after Bose published his work of the Mercury Coherer with telephone detector, Luigi Solaris, a friend of Marconi, started experimenting with invention of Bose & slightly modified it, prepared replica of the coherer invented by Bose & then Marconi used this apparatus replica to receive radio signals in his first transatlantic radio communication over a distance of 2000 miles in 1901. This story was written in the biography of Marconi by Solaris. This fact was recorded by a team of scientist of the IEEE in their research papers. In January 1998, the IEEE published a special issue where evidence was presented to show that Marconi had used the sensitive semiconductor diode device in the 1901 experiment invented by Bose in 1899.

The first successful wireless signaling experiment by Marconi on Salisbury Plain in England was done in May 1997. Marconi just used the same basic principles put forth by Bose & the same type of instruments as well. For his contribution using the ideas, principles & instruments, Marconi was honored with the Nobel Prize as the inventor of the radio.

Francesco Paresce Marconi, a well-known astrophysicist associated with NASA, the grandson of Marconi, has given Bose all the credit in the field of wireless communication when he delivered a lecture as the Chief Guest at the function at the Bose Institute in Kolkata to commemorate the 150th birth anniversary of Bose in 2008.

After reading about this demonstration in the newspapers, many businessmen approached Bose & requested him to sell his technology/ invention to them to use it commercially. But Bose expressed to them that "he had demonstrated his invention in front of the public & the public was free to use it." Despite this, Bhagini Nivedita obtained a patent in Bose's name in 1904 in the USA

During his presentation in 1897, Bose speculated the existence of electromagnetic radiation, explosions & storms on the Sun & its effect on wireless communication on & around the earth. This phenomenon was understood by the scientist after sixty years in 1942.

Bose developed a receiver of galena crystal; this use of a semiconductor junction to detect radio waves was the first of its kind in this field.

After this, Bose's experiment with millimeter wavelength, no further work was done on this topic till the 1950s.

The original apparatus made & used for demonstrations at Kolkata & London by Bose is on display at the Bose Institute at Kolkata. The replicas of his instruments are at GMRT, Khodad (Maharashtra) & also at Birla Science Center in Hyderabad. I have photographs of both in my collection.

My request to all VUs to celebrate 30 November, birth date of Aacharya J.C.Bose, as Indian Amateur Radio Day as homage to this "Father of Wireless Communication".

A unique way to pay homage to Aacharya J.C. Bose - AU2JCB - special call sign operation every year around his birth date - 30 November - Aachrya J.C. Bose was/is the versatile genius & as he is the "Father of Wireless Communication ", I decided during my school days to salute him using radio waves when I became a licensed amateur radio operator. I am operating for a period of one month, around 30 NOV -- the birth date of Bose- every year from 2005 (except 2006) with AU2JCB call-sign.

The details of my activity using the AU2JCB call sign from 2005 –

- Years of operation - 19. (The activity this year- 2025 will be 20th).
- Total look-ups on the qrz page of AU2JCB - 1, 08,725.
- Total qsos are - 40.000 approximately.
- e-qsls - 7,798.
- Hard copy qsls - 7,000 (approximately).

From 2005, many VU friends joined in this unique activity by taking special call-signs from the WPC with JCB suffix in the call-signs. The participants were VU2DCT, VU2UR, VU2HFR, VU2JAU, VU2LR, VU2SMN, VU3DJQ, VU2OB, VU2SMS, VU2ROE, Vu2ACK, and VU2EXP VU2EVU &VU2XPN.

The calls used by all above are AT0JCB, AT1JCB, AU1JCB, AU3JCB, AU4JCB, AU5JCB, AU6JCB, AU7JCB, AU8JCB, AU9JCB & AU0JCB.

I am proud to start this mission, telling the world about the great Indian scientist, the "Father of Wireless Communication" - Aacharya Jagadish Chandra Bose. The mission was/is very successful. Every year, I pay homage to this great man around his birth date - 30 Nov - I am telling the world, with the help of my amateur radio station using the AU2JCB call sign, all about his invention of electromagnetic waves & their transmission in 1885. During this period, JC Bose is present in my shack -- his portrait is near my radio. I feel Aacharya Bose is present & supervising my activity & giving blessings & he listens to my voice pronouncing "Aacharya J C Bose, is the father of Wireless Communication". The amateur radio in the world now knows J.C. BOSE & his contribution in the field of electromagnetic waves transmission. Many HAMS in the world have showcased my qsl depicting the picture of Shri J.C.Bose in their shacks.

I have conducted many programs around the birth date of J.C.Bose in the schools & colleges in Ahmednagar district with a demo on Amateur Radio. We celebrated the birthday at MIT College in Pune in 2016 & at Shivaji University in Kolhapur in 2019. A booklet was published during the Pune event & distributed to all students present for the program. The idea of Pune was of Vilas Rabade, VU2VPR & the Kolhapur event was managed by Shri Pramod Wasembekar, VU2XPN. I am writing newspaper articles every year. I have given lectures on local radio stations many times about the contribution of this great scientist.

In 2022, I delivered a lecture about Aacharya J.C. Bose and his contributions to the world of Wireless Communication, accompanied by a PPT, on 19 April 2022 at the monthly meeting of the Livermore Amateur Radio Klub in Livermore, California, USA.

This year, 2025, I, VU2DSI, along with AU2JCB & & VU2XPN (Pramod Wasembekar) with AU5JCB, will be operating from 21 Nov to 15 Dec 2023.

Effective Strategies for Ham Radio Contesting

By Ajaya (VU2DED)

Amateur radio contesting, often referred to as "radiosport," is a thrilling competition where Ham operators aim to make the highest number of contacts within a set time, on specific amateur bands and modes, and following defined rules. It's a true sport that tests both technical skill and strategy. Contests occur during specific dates and times, typically on standard HF bands—WARC bands (30m, 17m, 12m) are excluded. Common contest modes include CW, SSB, RTTY, FT8, and FT4, with some contests allowing multiple modes (mixed mode).

Contests take place nearly every weekend, each offering different categories so you can choose the one that matches your preferred mode, skill level, station setup, and the time you have available. You don't need a high-end 'super-station' to participate. I operate using a simple EFHW/Loop antenna with power normally not exceeding 100W.

Strategies for Achieving a High Score in Amateur Radio Contesting:

1. Contest Preparation - It is advisable to review the contest details at least one day prior to the start. Verifying key information in advance is essential. One of the first aspects to confirm is the contest timing. Due to the variation in time zones worldwide, it should not be assumed that the contest will commence at midnight local time. It is equally important to familiarize yourself with other contest-specific requirements, such as the type of serial numbers or exchanges that need to be sent, as these can vary from one contest to another. Additionally, reviewing the top scores from previous years can provide a useful benchmark, helping you set realistic goals for a competitive entry. Finally, ensure you are aware of any specific instructions for log submission, including the correct format and date/time for sending your log**.**

2. Equipment and Antenna Check - It is prudent to thoroughly inspect all equipment in advance to ensure optimal performance. This preparation phase also provides an opportunity to install a new antenna or implement other station improvements. However, it is important not to leave such tasks until the last minute, as unexpected issues could lead to the loss of valuable operating time during the contest. Any new equipment or antenna installations should be completed well ahead of the contest, allowing sufficient time for testing and final adjustments. Particular attention should be given to the antenna system. Since antennas are exposed to the outside, they are vulnerable to weather related wear and corrosion. All joints should be checked to confirm they are electrically sound, and the overall mechanical integrity of the antenna must be verified. Additionally, any moisture ingress into the feeder cable can significantly degrade performance by increasing cable losses. It is also important to note that a satisfactory VSWR (Voltage Standing Wave Ratio) reading does not always guarantee that the antenna system is functioning correctly. Power reflected by the antenna may be attenuated, resulting in an artificially low VSWR that could misleadingly suggest proper operation when, in fact, underlying issues persist.

3. Understanding Propagation -Propagation conditions play a crucial role in contest success. Study propagation forecasts on reliable websites shortly before and during the contest. Live ionospheric data and Reverse Beacon Network (RBN) can help gauge where your signal is reaching and its strength. Listening to band activity is also a smart way to adjust your operating strategy.

4. Antenna Direction - If using a rotatable beam, periodically adjust it as propagation changes. Rotating the antenna can open up new paths and uncover stations previously too weak to work.

5. Know Your Equipment/Software - Familiarity with your radio and logging software is essential. In the fast-paced contest environment, quick, confident operation makes a big difference. Take short breaks if you feel overwhelmed.

6. Use Alternative Modes - In multimode contests, switching modes can help maintain a steady contact rate. When SSB contacts slow down, switching to CW might help keep your score climbing.

7. Score Optimization - Focus on stations that serve as multipliers since they offer higher points. For example, in YBDXPI FT8, working YBDX members yielded more points, while domestic stations gave zero points but still counted as multipliers. Prioritize multipliers and valuable contacts to maximize your score.

8. **CQ vs. Search and Pounce (S&P)** Constantly calling CQ isn't always effective, especially under poor propagation. If your CQ calls aren't producing results, switch to S&P— scan the bands and call stations already active. This can help maintain momentum and optimize your score.
9. **Learn from Past Contests** - Review past contest logs and strategies. Identify what worked best—whether focusing on rare multipliers, band changes, or sticking to high-activity bands. Tailor your approach to the specific contest for better results.

   Join Contest Groups - Being part of a contesting group offers valuable learning opportunities. You can exchange strategies, join multi-operator teams, and gain hands-on experience that sharpens your contesting skills.

   Computer Integration - Linking your radio to a computer allows you to leverage advanced software for logging, rig control, and efficiency. In competitive contests, this technological edge can make a significant difference.

10. **FT8-Specific Contest Tips**

    Precise Clock Synchronization: FT8 (and FT4) demands tight time synchronization. Built-in PC clocks are often insufficient. Use third-party software like NetTime or a USB GPS dongle to keep your clock within 0.5 seconds accuracy, especially when operating without internet access.

    Transmitter Linearity: Ensure your transmitter operates in linear mode. Reduce power output by 3dB (e.g., from 100W to 50W) for better linearity. Avoid ALC overdrive, speech compression, noise blanking, or digital noise reduction when using FT8/FT4.

    Transmit Frequency: In FT8/FT4, do not call stations on their transmit frequency. Always use split frequencies—choose an open slot where no one else is transmitting. This applies both when calling CQ and when replying to CQ calls.

    Propagation Tools: Use online tools like PSK Reporter or HamSpots to see where your signal is being received and to gauge real-time propagation. This information can help guide band and timing choices without needing to make a contact.

Conclusion

The Amateur Radio contesting is a dynamic and rewarding pursuit that combines technical expertise, strategic thinking, and real-time decision-making. It offers operators of all experience levels an opportunity to sharpen their skills, experiment with equipment, and connect with the global Amateur Radio Community. Success in contesting is not solely dependent on having the most powerful station or the latest technology; rather, it is the result of careful preparation, efficient station setup, understanding propagation, and continuously refining operating techniques. By adopting the good practices and strategies outlined in this guide—such as proper equipment checks, effective use of propagation tools, mode flexibility, and smart logging—operators can significantly enhance their performance and contest scores. Every contest presents new challenges and learning opportunities, making it an engaging and educational aspect of amateur radio. With enthusiasm, persistence, and thoughtful planning, anyone can enjoy and succeed in this exciting facet of the hobby. See you on the air in the next contest!

My Experience in a HAM Hobby from a Non-Technical Background.

by (VU3IIA)

My interest in the HAM hobby began as a tech enthusiast during COVID-19. Spending ample hours on the internet, especially on YouTube, caught my attention on some electronic repair videos. Where I spend hours, it also sparked my curiosity to learn it from the ground up. That's when I searched on YouTube for the best textbook to learn electronics theory, where the ARRL Handbook was recommended among a few other options. Further research on ARRL revealed that there is something called HAM Radio. Where I also discovered that I can be one and operate in the same way. I registered on the Indian Telecom Portal and ordered an ARRL textbook from Amazon to prepare for the exam. That's when the second part begins.

I am a full-time working professional with a non-technical background. It's not that easy to learn the same without proper guidance. The terminology and content are highly technical from an electronic and electrical engineering perspective, primarily focusing on antennas and transceivers, which are based on these principles. The equipment and its components are expensive, with varied technical names, which require research to understand their applicability and use. Furthermore, the unavailability of equipment and components in India constrains the process, which must be imported mainly from the US or sourced through online portals or US/European sellers. The only hope for obtaining cheap equipment is from other HAM operators who, when they find they no longer need their extra equipment, start selling it. I have similarly bought some. Once you have all the equipment connected and operating, the next phase begins, which I am currently involved in—the experience I will share later, in similar short articles.

Amateur Radio Equipment Register

by C. Demastan (VU3DMT)

15. Amateur Radio Equipment Register

Each ASOC holder shall maintain record of amateur radio equipment used in the prescribed form.

S.No	Particulars of apparatus			Name and address of the person from whom received (in case of assembled by Authorised entity write self- made)	Date of Receipt of assembly
	Make	Model and Type	Serial Number		
(1)	(2)			(3)	(4)

In case of purchase, give receipt No. and indicate certificate No. of the seller	Name and address of the person to whom sold or transferred	Date of sale or transfer	Particulars of the certificate issued in the name of the purchaser	Remarks
(5)	(6)	(7)	(8)	(9)

New Amateur Radio Equipment register required to be maintained as per rule amendment enforced on 30th October, 2024.

The Amateur Radio equipment shall be kept in a safe condition and housed in such manner as to preclude access to unauthorised persons.

The certificate number purchased from the seller must be recorded in the register.

Separate pages may be kept for each device maintained by a HAM in the form prescribed below

Radio Telescopes and Coexistence with Powerline Noise

by Kaushal D. Buch (VU3KDT)

Radio telescopes are sensitive radio receivers operating in the HF, VHF, UHF, and beyond, up to tens of GHz, for studying celestial objects that emit in these frequency ranges. They consist of a single dish or an array of antennas, receiver systems, and signal processing backends, for detecting faint signals coming from distant parts of the Universe. Since these receivers are passive, wideband, and extremely sensitive, they are affected by in-band and out-of-band interferences from various sources. One of the major sources of interference (or noise in common terms) for these telescopes in the lower frequencies (HF, VHF, and UHF) is from powerlines, automobiles, lightning, and similar sources. This article will describe a solution for filtering powerline Radio Frequency Interference (RFI) in the digital signal processing chain as implemented in the Upgraded Giant Metrewave Radio Telescope (uGMRT). This telescope is one of the most sensitive radio telescopes in the world, located near Pune, India, and operating in the VHF and UHF range (120-1450 MHz). It is an array of 30 antennas, each a 45m diameter dish, spread in an area of 25km. uGMRT is today at the forefront of astronomical research and uses contemporary signal processing techniques. It is important to tackle RFI as it affects the astronomical observations due to reduced sensitivity and dynamic range, an inability to detect weaker radio astronomical sources, and impaired astronomical imaging.

This article will discuss coexistence with powerline RFI at GMRT and will also draw parallels on the usage of such a technique for the HAM radio transceiver.

Coexistence with powerline RFI:

Powerline interference at uGMRT is mostly due to gap discharge (or sparking) on high-power transmission lines, transformers, electrical equipment, etc., located in and around the GMRT array. RFI can also be due to corona discharge, sparking on automobiles, and inductive load switching. There are various conventional methods being used to protect the GMRT receiver system from powerline RFI. These include preventive approaches like identifying and solving the faults on powerlines and associated equipment. For controlling self-generated RFI, shielding, and electronics solutions, like using powerline filters, are used. Since the external sources are too many in an area spanning about 25-30 km, it is practically not possible to solve all possible faults. Hence, powerlines remain a major source of interference in the 120 - 850 MHz observing bands of the uGMRT. The approach used for uGMRT is to coexist with these sources by finding a solution in the receiver system.

uGMRT real-time powerline RFI filter:

In the last decade, while the GMRT receiver was being upgraded, a solution was proposed to mitigate powerline RFI in the digital signal processing system. Since this RFI is impulsive in the time domain (i.e. broadband in the frequency domain), the mitigation scheme operates on digitized time samples. The powerline interference seen at the input of the uGMRT digital receiver is shown in Fig. 1. The astronomical signal is random noise, and the RFI can be seen as a bunch of sharp-rising impulses repeating every 10ms (twice in the AC cycle, which is 50 Hz in India).

Real-time RFI filtering establishes a threshold for the digital input signal coming from each of the GMRT antennas and replaces the region where the impulsive interference is detected by healthy samples. The threshold is arrived at by using a median-based robust estimation of the signal RMS. Detection can be done either on each voltage sample or squared and added (square-law detector) outputs. In case of square-law or power detection, the results are best when matched with the typical duration of powerline RFI. Detection is followed by filtering, where the following options are provided to replace the RFI samples:

Zeros (Blanking) or constant value Threshold (Clipping)

Noise (as the astronomical signal resembles random noise)

A simplified block diagram of the uGMRT real-time RFI filter is shown in Fig. 2. The three main constituent blocks are the Estimation, Detection, and Filtering.

The filtering as seen simultaneously on the unfiltered and filtered data is shown in Fig. 3. A more detailed reading about the technique, implementation, and the results from this system is provided in references 1-4 below.

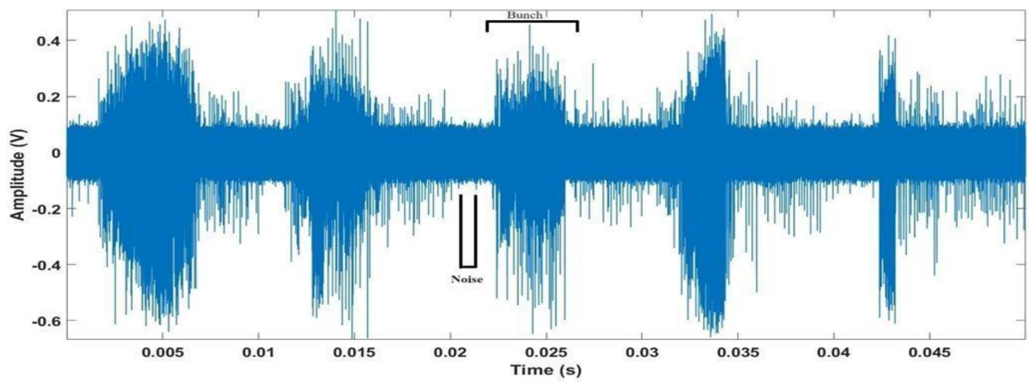


Figure 1: Digitized time-series (uGMRT, 550-850 MHz) containing powerline RFI, seen as a bunch of impulsive spikes repeating every 10ms (50 ms plot shown here, taken at 5ns time resolution)

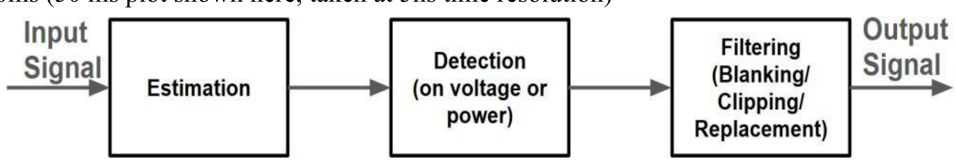


Figure 2: Simplified block diagram of the building block of the real-time powerline RFI filter

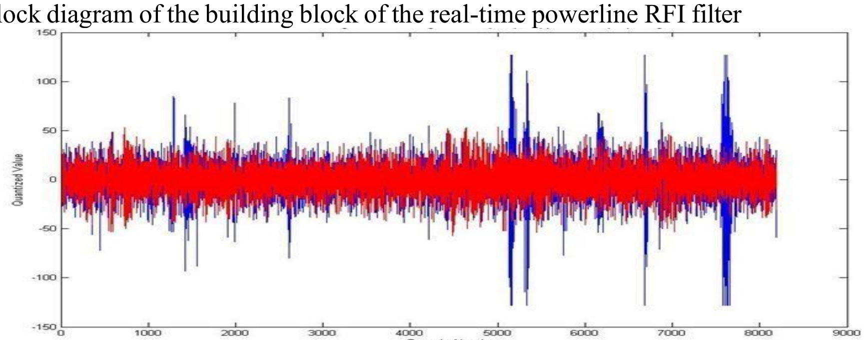


Figure 3: Unfiltered timeseries (blue) and corresponding (red) for the uGMRT 150 MHz signal for an antenna. Quantity on the X-axis is the sample number; each sample corresponds to 2.5ns time.

Powerline RFI and its filtering can also be observed in the frequency domain. Fig. 4 shows the time-frequency plot for a single GMRT antenna. The left plot shows the spectrum with powerline RFI, where this type of RFI is seen as broadband and repeating every 10ms. A simultaneous filtered spectrum (right plot) shows the removal of broadband RFI. This is another confirmation of the removal of broadband powerline RFI using the filtering method described above.

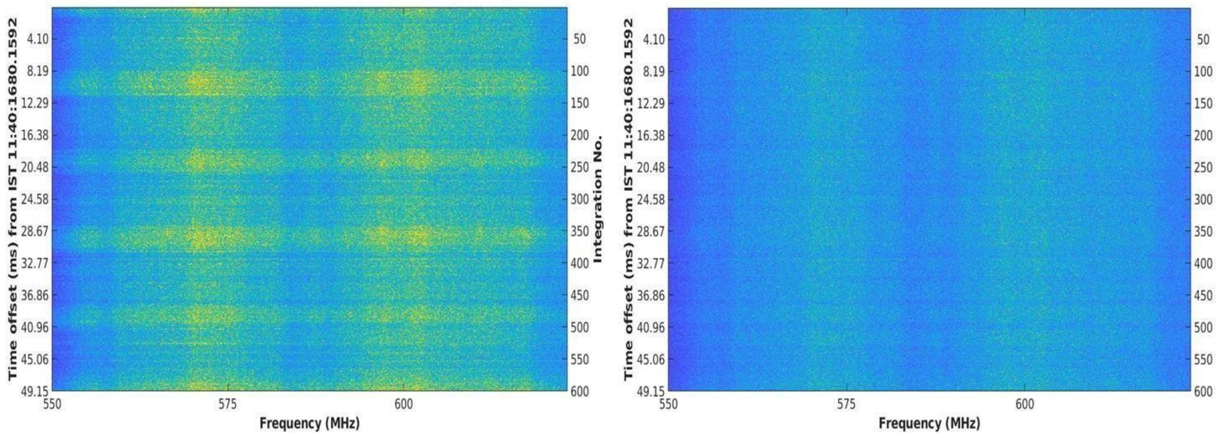


Figure 4: 50ms time-frequency plot of GMRT antenna for 550-650 MHz. Left plot (unfiltered) and Right (filtered). Yellow lines in the unfiltered antenna show powerline RFI repeating every 10ms.

This technique is the first of its kind to be implemented in real-time in a radio telescope. It was released as a part of the uGMRT receiver system a few years back and is being widely used in various astronomical observations. The benefits of this technique are improved dynamic range in astronomical imaging, detection of weak radio sources, and improved calibration in the presence of RFI.

B. Relevance of the uGMRT real-time RFI filtering to HAM radio:

HAM radio operates in a frequency range that overlaps with uGMRT receivers, so they get similar interference from power lines, automobiles, and inductive load switching. The differences are in the receiver sensitivities and the signal structure. Some of the solutions proposed for powerline RFI mitigation in HAM radio [5-7], and being used or proposed, align with the powerline RFI filtering described earlier. Most of these use a noise blanker, where the audio gets blocked for the duration of the powerline interference. The duration and the level at which it discriminates between the signal and interference are adjustable. A filter conceptually similar to the one used for uGMRT can also be thought of for HAM radio, in which case some refinements may be needed to the existing approach. A noise blanker using such a technique can be designed for various thresholds and different options for filtering, like blanking, clipping at the threshold level, etc., can be incorporated. If the typical duration and amplitude of the powerline interference are known, one can use an averaging circuit before the detector/comparator for better detection. Such a system can be implemented using analog circuits or digital ones, as the case may be. However, a digital solution is preferred considering the accuracy and complexity of the technique.

Amateur Radio Society of Assam(ARSA) in NER since 2005

by B. Barman - VU2XBP

Amateur Radio Society of Assam (ARSA) was estabilished in the year 2005 in Guwahati for the service of entire NER. Now, ARSA's members are from Assam, Meghalayas, Arunachal, Manipur, Mizoram, Tripura and Nagaland.

Ham Radio demonstrations are done in various well known and reputed institutes like as - IIT,Guwahati, IISF,Guwahati, Gauhati University, Modern English School, Guwahati, TISS, Royal Global University, etc.

ARSA successfully arranged 3 batches for ASOC Examination in Guwahati and successfully passing out 100+ hams. ARSA's members are regularly joining HF (7.070,7.145 MHz etc,etc) and VHF Net. VHF Net is operating regularly in Guwahati at 145.100 MHz.

Now, ARSA's VHF Repeater is ready in Guwahati for rendering services to Hams. ARSA is preparing for holding NER Ham meet in Guwahati and going to arrange 4th ASOC Examination in Guwahati in 2025.

In field day categories -Lots of field days are successfully arranged in various parts of Assam. Last year, we successfully hold NER Hams eyeball QSO in our Annual General Meeting. ARSA has given supports recently to NER Motor Sports festival in near by Guwahati.

AU25KVD, A Historic Journey to LADAKH

by George, VU2XFD

Ladakh, the land where the heaven touches the Earth. A place touches your soul and leave you speechless. In this rugged land and diverse ecosystem, it's very difficult to survive. You need a strong body and mind. Probably, this was mine first and last HF transmission to the world from a restricted and rear military zone of Indian Army being a HAM Radio operator.

Last year India had celebrated the twenty fifth (25th) year of Kargil Vijay Diwas and following this national event, Ministry of Defence and Ministry of Communication were decided to remembering the

great sacrifice of people of Kargil and our brave soldiers those who lost lives during Kargil War in 1999. History helps us to recall our victory again by this initiative of Government of India.

It was an open opportunity to all Ham Radio Clubs in India to participate in the Kargil Vijay Diwas, Forever-In-Operations Divisions. We were the smallest team from the Indian Wave of Amateur Radio (IWAR), VU2IWA among eight other clubs in India, met to the standards and requirements of Indian Army to join in this historic event from all aspects.

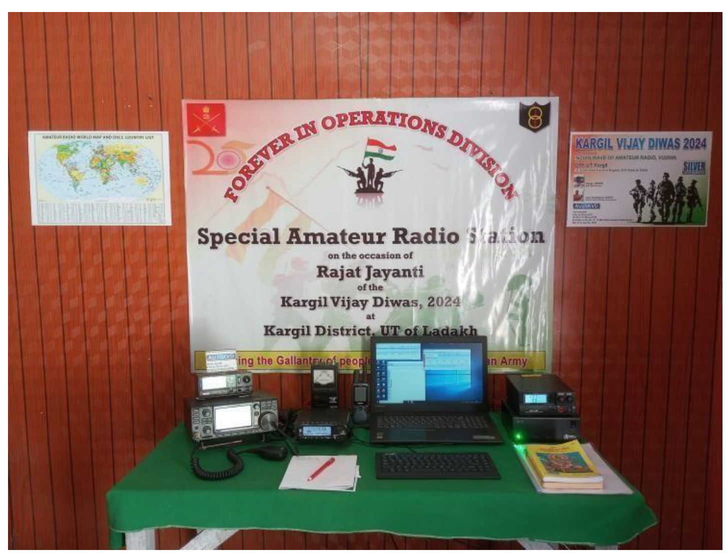
AU25KVD was the special callsign to IWAR to run the HF radio from the heights of around 9500ft to the globe. Our team was consisted with only two person that is Tapas Kr Chakraborty, VU2TKC (65) & George, VU2XFD. It was a single operator-based program activate AU25KVD.

However, we missed an opportunity to visit 13,500ft due to physical issue to our mentor VU2TKC. His altitude sickness was recovered later by an excellent treatment in Military Hospital, Kargil.

To join in this historic program, it was a really serious challenges on me to establish successful contacts among HAMs to spread the theme of Kargil Vijay Diwas 2024.

So, from the day one I started to turn on the HF radio at 06:30 hrs at near to the freezing cold. Army jeep used to come at sharp 6:00 hrs. My breakfast and lunch were fixed in Army Barracks.

I used two latest HF Radios with 49:1 EFHW antenna and my signal was booming towards the Russia, China and East European Countries. Due to excessive fall of temperature at evening, I was not allowed to operate after 19:00 hrs, even it was my special request to the commanding officer who extended it from 16:00 hrs. I was planned for 16 hrs operation which was not possible.



On May 31, 2024, we had started our first CQ Call to the world from an Indian Army controlled area at Kargil, Ladakh and It continued till June 02 at 19:00 (IST). It was really an unforgettable moment for me to receive nice responses from across India and abroad.

Apart from technical, physical & mental challenges in this operation, I was blessed to see and to realise the continuous sacrifice of people at Kargil, the discipline and dedicated service of Indian Army, the cold wind and the fast moving clouds, the pink flower in the dry edge of stone, the Kashmiri tea & butter nun from a war survivor Ms.Halima Raza, and smile of local kids and their questions about what we were doing.

I am very much thankful to Brigadier Jaydeep Chandra, VU2YYE and his team of soldiers for the continuous support to us and implementing this program to a great success. I was lucky enough to touch the dust of Ladakh while wrapping up my coaxial cable and antenna wires.

Every moment was an epic adventure to me and I have seen the grand design of Ladakh while returning to home.

HAM Radio in India and Its Future: Navigating Challenges, Harnessing Opportunities

by H.N.Singh VU2YUH

In an age dominated by smartphones, high-speed internet, and satellite communication, HAM radio — also known as amateur radio — might appear outdated. However, it remains a vital tool for emergency communication, experimentation, and community service, especially in a vast and diverse country like India. With its deep-rooted legacy and evolving relevance, the journey of HAM radio in India is both inspiring and filled with challenges. Understanding its current status and potential future reveals a story of resilience, innovation, and hope.

The Legacy of HAM Radio in India

HAM radio in India dates back to the colonial era, with early enthusiasts setting up wireless sets to communicate across regions. After Independence, the government began regulating amateur radio under the Indian Wireless Telegraphs Act, 1933. The Wireless Planning and Coordination (WPC) Wing of the Ministry of Communications now governs the licensing and operation of HAM stations.

Today, India boasts thousands of licensed amateur radio operators, affectionately known as "Hams." These enthusiasts engage in two-way communication, experimentation with radio waves, satellite operations, and more importantly, disaster communication support.

The Role of HAM Radio in Emergencies

One of the most significant contributions of HAM radio in India has been during natural disasters. When conventional communication fails, HAM operators step in. During the 2001 Gujarat earthquake, the 2004 Indian Ocean tsunami, and the 2018 Kerala floods, HAM operators played a critical role in coordinating rescue and relief efforts.

Their ability to set up communication networks using simple, battery-powered equipment makes them invaluable, especially in rural or remote areas. This utility gives HAM radio a continuing relevance in India's disaster management strategy.

Current Facilities and Ecosystem

India's HAM community is supported by organizations like the Amateur Radio Society of India (ARSI) and National Institute of Amateur Radio (NIAR), which help in training, licensing, and technical advancement. The Government of India issues various categories of amateur radio licenses, such as Restricted Grade and General Grade, depending on a candidate's technical knowledge and Morse code proficiency.

Facilities available to Indian Hams include:

HF (High Frequency), VHF, and UHF bands for experimentation and communication. Satellite

operation, including India's own HAM satellite, HAMSAT (launched in 2005).

Access to digital modes, like FT8 and D-STAR, which blend traditional radio with internet-based technologies.

Regular field days, contests, and awareness programs that build community engagement.

Several schools and colleges are also adopting HAM radio clubs, introducing young minds to electronics, communication, and public service.

Challenges Facing HAM Radio in India

Despite its usefulness and heritage, HAM radio faces a range of challenges in India:

Lack of Awareness

Many citizens, especially the youth, are unaware of amateur radio's existence or purpose. It is often perceived as a hobby for the elderly or technophiles, not as a powerful tool of communication and learning.

Cumbersome Licensing Process

The current licensing process, though improved over the years, still includes bureaucratic delays. Long waiting periods after the examination and frequency allocation discourage new entrants.

Inadequate Government Support

While agencies like NIAR have made efforts, government support in terms of funding, policy encouragement, and integration with educational curriculums remains minimal.

Technological Competition

With mobile networks and the internet available even in rural areas, many believe HAM radio is redundant. This misconception is slowly eroding its popularity and institutional relevance.

Cost of Equipment

Quality transceivers, antennas, and accessories can be expensive, and most are imported. This becomes a barrier for students and enthusiasts from economically weaker sections.

The Future of HAM Radio in India

Despite challenges, the future of amateur radio in India is promising, provided the right steps are taken:

Integration with Disaster Management

Formal recognition of HAM operators in national disaster response plans could enhance both preparedness and volunteer enthusiasm.

Educational Outreach

Introducing amateur radio as a co-curricular activity in schools and colleges can spark curiosity in science, electronics, and communication.

Simplification of Licensing

Streamlining the examination and licensing process — possibly with online options — can widen the base of operators.

Local Manufacturing and Cost Reduction

Encouraging start-up's and entrepreneurs to build indigenous HAM equipment could reduce costs and make radio more accessible.

Digital Fusion

Integrating HAM operations with modern technologies like IoT, AI, and SDR (Software Defined Radio) can make the platform relevant for research and innovation.

Women and Youth Participation

Encouraging participation from underrepresented groups can revitalize the community and introduce diverse perspectives and talents.

HAM radio in India is at a crossroads. While its historical contributions and technical potential are undeniable, it faces an uncertain future without active revival. With strategic support from the government, institutions, and the community itself, amateur radio can not only survive but thrive — serving as a bridge between technology and humanity, hobby and service, tradition and innovation.

In a world where everything digital is vulnerable to failure, HAM radio remains a timeless tool — silent yet powerful, old yet evergreen. Its true future lies not just in technology, but in the spirit of connection, curiosity, and service that drives every HAM operator across India.

Digital HAM Radio in India: DMR and Beyond

by Prof. (Dr) Santanu Mandal. VU3NLQ

Indian Amateur (HAM) radio is quickly adopting digital voice modes, particularly the ETSI-standard Digital Mobile Radio (DMR). Voice in digital HAM radio is encoded as binary data instead of analog FM. For instance, two-slot TDMA 12.5 kHz channels are used in DMR such that two calls can be made in one channel [1]. The outcome is better sound (DSP filtering eliminates noise) and much improved efficiency compared to analog FM [2][3]. Digital radios tend to have features such as GPS, text messaging, and encryption [3][4]. Briefly, DMR and other such modes offer hams crisp voice, increased range, and data capabilities (e.g., position or telemetry) not on vintage analog rigs.

Adoption of Digital Modes in India

Indian amateur groups have started establishing digital infrastructure. Clubs such as the Indian Institute of Hams (IIH) at Bangalore and India Hams Amateur Radio Repeater Club at Delhi operate DMR repeaters and nets. West Bengal Radio Club (WBRC) is also building up their infrastructures for DMR repeaters and net in eastern zone.[5]. There are reports from ARSI newsletters that hams are organizing workshops and tech talks on DMR and other digital modes[6][7]. On Sundays, numerous operators also participate in an "India" talkgroup net (TG404) and discuss over DMR, similar to conventional nets on analog repeaters.

A second significant adoption initiative is educational. As part of the "Ham Yatra" program in Karnataka, 20 new DMR base stations were installed at rural school radio rooms [8]. School teachers and students were trained and even wrote amateur license exams through online modules. These DMR links enable remote students to "extend their reach to scientists and researchers" globally [9]. Notably, the school stations also act as emergency communication centres in disaster zones [9]. This IIH project demonstrates how digital HAM nets are being incorporated into education and local emergency preparedness.

There are hundreds of hams with DMR radios and hotspots and an increasing network of DMR repeaters across India. Apart from BrandMeister, DMR-MARC networks and hotspots (Raspberry-Pi-based Pi-Star nodes) connect Indian users into international DMR clusters [10]. The Amateur Radio Society of India (ARSI) – the IARU member society – enthusiastically supports these trends. Recent ARSI news mentions "understanding of digital communications" including DMR at conferences [6], and even mentions that digital modes are getting "more popular" among new arrivals [11]. Combined, these trends show digital HAM is increasingly a component of the Indian hobby today.

Advantages of Digital Modes

Digital voice brings several benefits over analog FM:

• Audio Quality & Range: Digital processing eliminates background noise and "fills in" missing data, so voice remains crisp even at the edge of coverage [2]. Unlike analog (which breaks to static), DMR will frequently break off cleanly only when the link is gone.

• Spectral Efficiency: Two-slot TDMA of DMR results in two concurrent conversations within a single 12.5 kHz channel [1]. This is double capacity over analog FM. (Hytera explains that DMR radios "use two slots" to support twice as many calls [1].)

• Data Features: A majority of DMR radios have GPS logging, text/email messaging, and APRS-like data capability. For instance, hams are able to send short messages or utilize GPS to automatically transmit locations. Most rigs also include built-in text chat and a private-call function [3][4].

• Battery Life & Functionality: By communicating in short bursts, DMR radios typically have superior battery life to analog, and can also offer services such as emergency beacons, voice encryption, and even firmware over the air upgrades.

These advantages render DMR favourable for technical and emergency application. As an example, operators mention that digital radios enable "improved signal efficiency" and "features such as text messaging and GPS location" which analog does not offer [3]. In operation, Indian users mention improved audio on DMR repeaters and find it fun to experiment with data modes and hotspots on the VHF/UHF bands.

Challenges and Regulation

Even with the promise, adoption is hindered. Equipment and Cost: Handheld DMRs or mobile rigs of average quality are a few thousand Rupees from. Hotspots (DMR dongles) are less expensive, but a full repeater network is still pricey. Most Indian hams use Chinese imports (e.g., Baofeng, TYT) which are WPC ETA (Equipment Type Approval)-compliant. WPC approval can be time-consuming and expensive, so it restricts the availability of legal DMR radios in India.

Licensing and Infrastructure: Amateurs are required to possess a valid WPC Amateur Station Operator's Certificate (ASOC) in order to employ these modes. To the good, Indian licensing is becoming digital: the 2024 Amateur Service Rules require electronic ASOC certificates and all licenses are being issued through the DoT's SARAL Sanchar portal [12]. This simplifies new ham licensing. Building network infrastructure takes longer, though. There are fewer new digital repeaters than analog ones, and some areas don't have any DMR coverage at all. Operators would need an internet connection or hotspot device to access remote users, when analog might be necessary simplex in the field. And training is required: new hams will have to learn how to program channels, colour codes and talkgroups. Clubs such as ARSI, West Bengal Radio Club (WBRC) are organizing workshops to train operators, but quite a number of analog only hams still have to up-skill and up-equip themselves.

Future Outlook

The prospects of digital HAM in India are bright. Operators at home note a clear pattern: "digital modes are gaining more and more popularity" and even some traditional competencies such as CW (Morse code) are less stressed [11]. ARSI contests and nets are progressively recognizing digital classes. The educational DMR setups in Karnataka indicate that a new generation is becoming interested in radio and STEM through digital ham.

Concurrently, public services and the government are making digital radio mandatory – an indication of good times for amateurs. India's National Communication Standard (2022) in clear terms advises "robust conventional digital radio VHF/UHF DMR Tier-II" networks for police, disaster management and public safety [13]. While state police and emergency agencies develop digital trunked networks, trained amateur operators could one day be used in emergencies or be interfaced in community radios, in line with ARES models elsewhere. Some hams already take part in disaster training and might connect their DMR equipment to provide local relief.

In tech, innovation never stops. Open-source initiatives such as Pi-Star hotspots and even newer digital voice modes (YSF, D-STAR, and new modes such as M17) provide Indian hams an experimental tool. Increasing numbers of repeaters are being planned in major cities, and clubs are establishing digital nets (e.g. regional TG talkgroups). Training programs (online webinars, tech talks at Hamfests) continue to expand. With licensing going digital and affordable hardware available, the digital ham community in India is well set for consistent growth.

In short, digital HAM radio (particularly DMR) is becoming a lively segment of India's amateur community. Operators get good-sounding audio and sophisticated features, but have to contend with expenses and regulations. With permissive licensing reforms [12] and promoting community

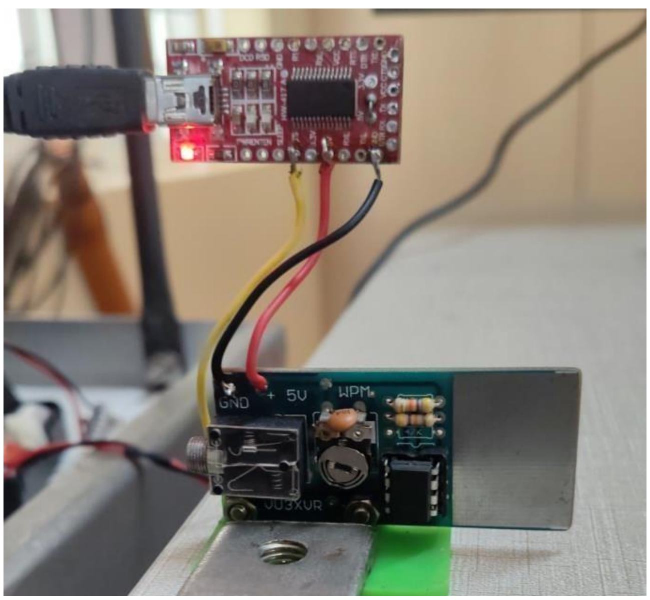
initiatives (such as school radios)[8], digital modes are set to grow. Indian radio amateurs – from enthusiasts to emergency responders – are slowly embracing DMR and other digital systems, connecting India's airwaves with the international digital amateur world.

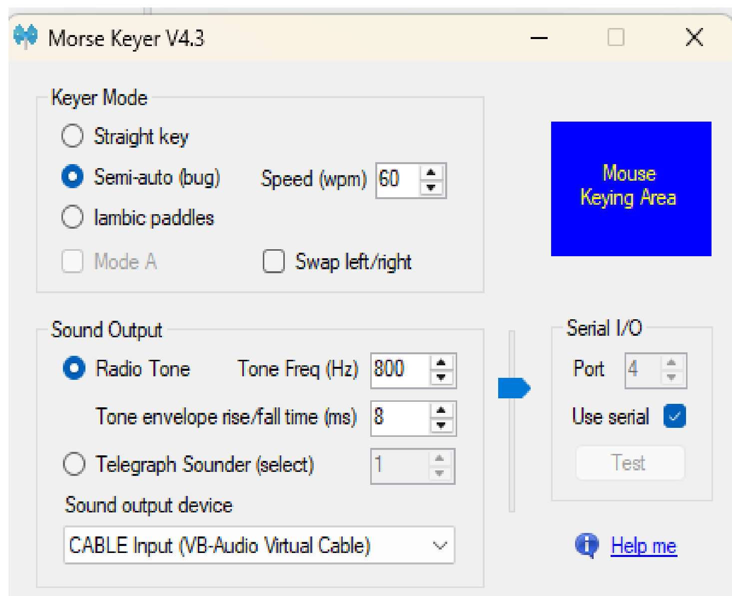
CW for QO-100 using SDR Console

by Ram Mohan, VU2GRM

A Touch Keyer by VU3XVR, now VU2RWH is used to key through SDR Console by Simon Brown. The O/p of the speaker is connected to the CTS terminal of an FTDI Chip. Through Morse keyer software by Om John Samarin is connected to the virtual audio cable to the TX section. Power for the keyer is drawn from the USB port.

The Console should be kept in USB Mode. A straight key can be connected between CTS and ground. I have been using this for many years and is doing a good job.



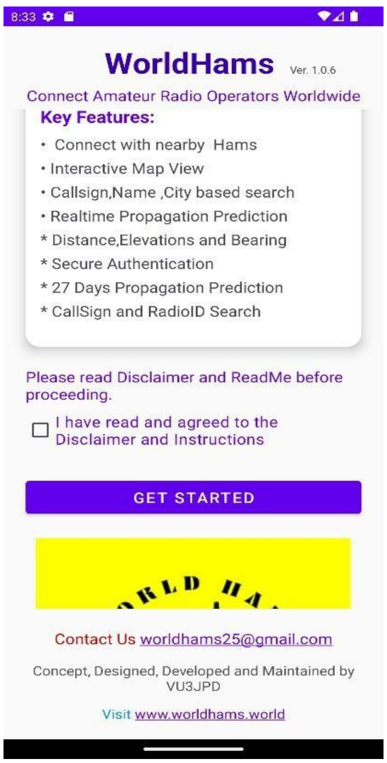


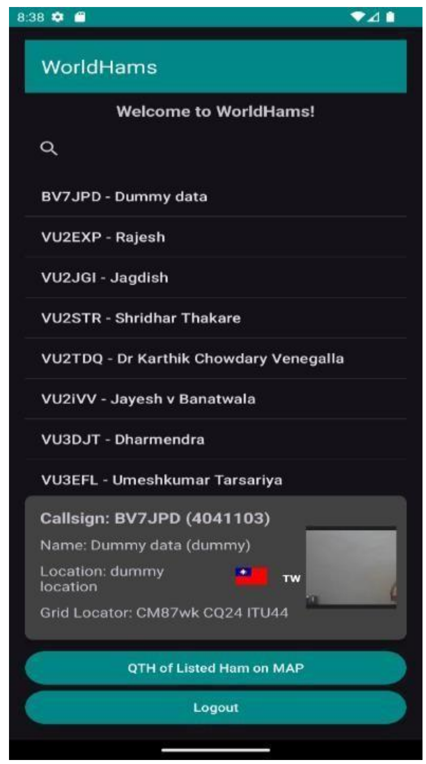
“WorldHams” a mobile app giving Map View information of Hams along with real-time prediction , wave propagation forecasting between stations.

by V. B. Parmar VU3JPD

This application gives information of worldwide hams like Callsign, Name, Handle, and geographically location and locator of stations. Hams can test their antennas and other technical experiments as this app gives bearing, distance between two hams and elevation of the QTH, line–Of-Sight obstruction, etc

It is capable of predicting wave propagation using real-time/latest data from NoAA satellites. It also give 27 days HF propagation forecast





What this App collects: App collects data like **Name**, **Email**, **Callsign**, **Handle**, **Location Name (Qth), VHF/UHF antenna Height**, **Contact Number(optional)**, **RadioId** and **Profile Photo** (optional). Location coordinates fetched automatically once) with user permission.

1. **Publicly Visible Information**:

   Only **Name**, **Callsign**, **Handle**, **Elevation, RadioId, Grid Locator, CQ Zone, ITU Zone ,ISO2 Code & Flag of country** and **Location Name** are visible to other authentic users of this app.

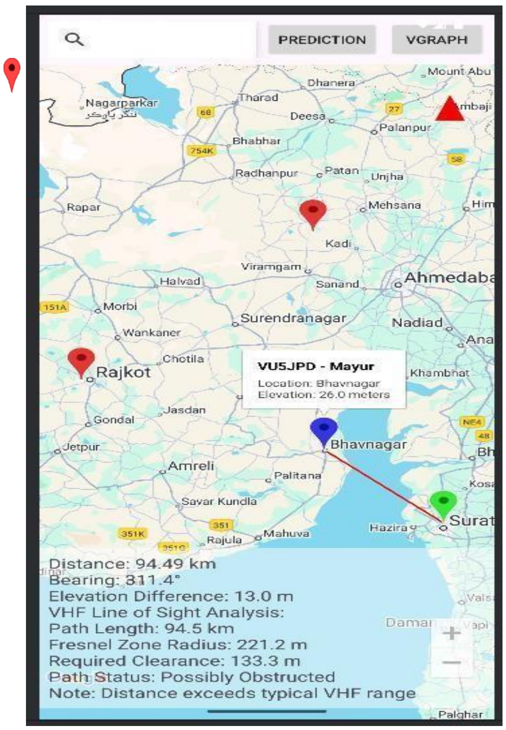
2. **Permissions** : Internet permission, Location permission(one time) and Media gallery/Camera permission (once)
3. **Data Security**:

   All user data are securely stored on a secure cloud server. Data from user device to server are encrypted in transit.

1. **Signup**: SignUp only from your QTH exclusively. Valid email is required.

2. **List of Registered Hams (List View\Card View) :** Here you can see list of users(Hams) who have registered , his/her CallSign, Name . Searching facility is there. Card View display Callsign, Name , Handle, City ,RadioId, Grid Locator, CQ Zone ,ITU Zone,ISO2 Code & Flag of the country and photo of the user (Ham). From here user can chat with selected user just like other social media app. List shows some dummy data just to display features. Read same for Map View below.

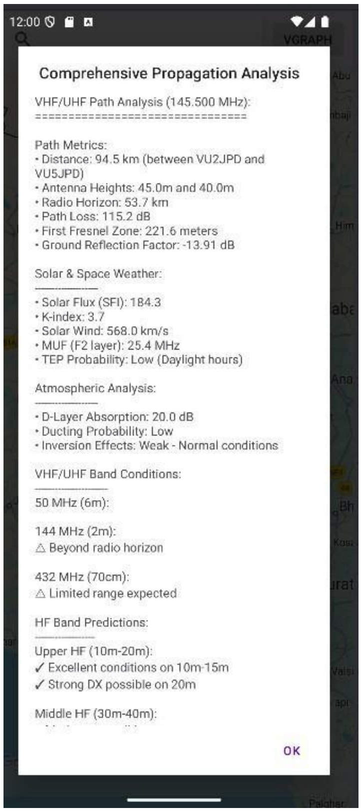
3. **Map View (<u>Very important section of this App</u>).:** Opening MapView , user can see locations of Hams across Globe like



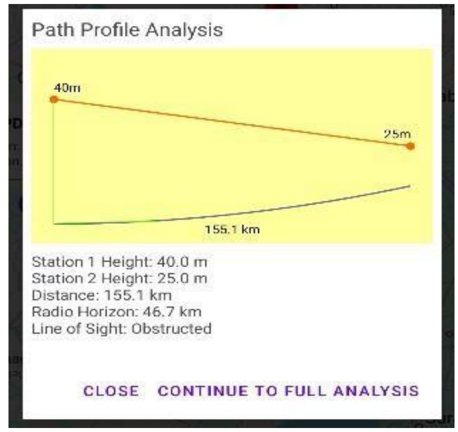
a) After two stations selected, info window will be open which will display distance between two stations, bearing (clock wise angle from north) , elevation difference of both stations.VHF Line of Sight Analisys, Fresnel Zone Radious[1] , required Clearance[3] .

b) App starts searching along line drawn (line of sight) to find whether any obstruction is there between two stations or not.

c) There is Prediction section. When both stations selected and info window open to display above information, "Prediction" button will Visible at top right corner. Another window will popup shows more information for radio wave propagation for current time and day.



Prediction Info Windows



These features will be displayed in prediction section makes more realistic prediction. Band wise prediction also there. <u>All these prediction is make possible because this app fetching real-time latest data of NOAA servers</u>. Note that this view is scrollable, so do not forget to scroll up. (Credit to NOAA)

4. **HF Radio Wave Prapogation prediction for 27 days. This link is available on Login screen**

It will open a calendar style 27 days grid. Each grid displays values of Radio Flux Index (SFI) ,A index, Kp Index which are fetched from NOAA sites. Clicking On any grid will display band wise prediction for that selected day as under. Color code is representation of Good, Moderate and **Poor** propagation condition and it is automatically shows reading each grid's values.

5. CallSign and RadioID searching facility is there on login Screen.

Contact: worldhams25@gmail.com 9909028750 . Please do visit www.worldhams.world for more details

Evolution of Wireless Communication: A Story of Cornerstone Results

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Vidyalankar Institute of Technology

Abstract—**Communication has always been a cornerstone of human interaction, enabling the exchange of ideas, information, and emotions across time and space. The journey of communication evolution is marked by revolutionary breakthroughs that have transformed how we connect. This paper aims to explore the evolution of wireless communication and shed light on the influential roles played by eminent scientists in shaping this field.**

Keywords*—*Fourier's Theorem, Morse Code, Wireless Signal Propagation, Nyquist-Shannon Sampling Theorem, Mathematical Theory of Communication, Impact, Digital Communication, Wireless Technologies, Modulation, Signal Processing.

I. Introduction

Communication, the vital thread that weaves societies together, has undergone a transformative journey through the annals of history. From the ancient drumbeats and smoke signals that conveyed primitive messages to the digital highways that connect our globalized world, the evolution of communication has been a testament to human ingenuity and scientific progress.

This article explores this evolution, delving into the pivotal role of visionary scientists in shaping the realm of wireless communication. The works of Joseph Fourier, Samuel Morse, Jagdish Chandra Bose, Harry Nyquist, and Claude Shannon serve as the cornerstones upon which the edifice of wireless communication stands. By delving into their contributions, we gain insights into the mechanisms that underpin our interconnected world[1-11].

II. Wireless Communication

A. *What is Wireless Communication?*

Wireless communication is the technology that enables the exchange of information between devices without the need for physical connections like wires or cables. It relies on transmitting electromagnetic waves like radio and microwaves to carry data over various distances. This technology underlies diverse applications, including mobile communication, Wi-Fi networking, Bluetooth connectivity, satellite communication, and the Internet of Things (IoT), offering the advantages of mobility, convenience, and pervasive connectivity. However, it also poses challenges related to signal interference, security, and spectrum management to ensure efficient and reliable communication in our increasingly wireless-dependent world.

B. *How has it been a historical revolution?*

Wireless communication has become essential to our daily lives, enabling us to communicate and access information wirelessly. Here are some critical points about wireless communication:

1. Wireless communication is transmitting information without using physical connections such as wires or cables.
2. The history of wireless communication dates back to the 17th and 18th centuries when experiments were carried out to understand the magnetic and electric properties observed during those times
3. The development of wireless communication has been a gradual process, with significant contributions from scientists such as Joseph Fourier, Samuel Morse, Jagdish Chandra Bose, Harry Nyquist, and Claude Shannon.
4. Wireless communication has evolved rapidly and is a cornerstone of intelligent infrastructures.
5. The future of wireless communication is promising, with the development of 6G technology, which is expected to become a framework of services, including communication services.

Wireless communication has revolutionized how we communicate and access information, making it more accessible and convenient.

C. *The evolution of communication*

From the earliest forms of communication etched in cave paintings to the sophisticated digital landscapes we traverse today, the journey of communication is marked by quantum leaps. The rise of the printing press, the advent of telegraphy, and the propagation of radio waves were not mere chronological advancements; they redefined the boundaries of human connectivity.

The transition from wired to wireless communication emerged as a watershed moment, transcending geographical and temporal barriers. This transition rested on the pioneering efforts of individuals who harnessed scientific principles to revolutionize how information is disseminated and received.

III. The Cornerstones Of Wireless Communication

Communication has evolved significantly, with wireless communication a major milestone. Here are the fundamental cornerstones of wireless communication and the contributions of top scientists:

A. *Joseph Fourier* (Discovered Fourier's theorem in 1807)

- ❖ Contribution:

1. Fourier's Theorem (1807): Joseph Fourier's seminal contribution was the development of Fourier's theorem, a mathematical breakthrough that revolutionized the analysis of periodic signals. The theorem established that any complex waveform could be decomposed into a sum of more straightforward sinusoidal functions.
2. Mathematical Representation: Fourier's theorem introduced the formula for expressing a periodic function as a series of cosine and sine terms, each representing a specific harmonic frequency. This formula provided a systematic way to break down intricate waveforms into their constituent frequency components.
3. Basis of Signal Analysis: Fourier's work provided a powerful tool for understanding the frequency content of signals. It allowed scientists and engineers to delve into the composition of signals, revealing the importance of different frequency components.

Fig.1. Joseph Fourier [11]

❖ Impact:

1. Signal Modulation and Demodulation: Modulating signals by varying their frequency, amplitude, or phase is crucial in wireless communication. Fourier's theorem is the foundation for understanding how modulation works. Engineers utilize this understanding to encode information onto carrier signals for wireless transmission.
2. Efficient Signal Transmission: By analyzing and manipulating signals using Fourier analysis, wireless communication systems can optimize signal transmission efficiency. Engineers can design modulation schemes that maximize the use of the available frequency spectrum and minimize signal interference.
3. Signal Processing Techniques: Fourier analysis underpins various signal processing techniques used in wireless communication. Filtering, equalization, and channel estimation rely on the decomposition of signals into their frequency components. This enables the extraction of information from noisy signals and the enhancement of signal quality.
4. Spectral Efficiency: Efficiently utilizing the limited available spectrum is crucial in wireless systems. Fourier analysis aids in understanding how different signals interact in the frequency domain, allowing for the design of communication systems that minimize spectral interference.
5. Wireless Network Optimization: The ability to analyze signal properties using Fourier analysis contributes to optimizing wireless network performance. Engineers can design networks that deliver reliable communication by strategically managing signal interference and propagation characteristics.

B. *Samuel Morse* (Developed Morse code in the 1830s)

❖ Contribution:

1. Morse Code (1830s): Samuel Morse's pivotal contribution to wireless communication was the invention of Morse code, a system of encoding messages using a series of dots and dashes. He developed this coding system to facilitate communication over telegraph wires.

Fig.2. Samuel Morse [11]

❖ Impact:

1. Revolutionizing Long-Distance Communication: Morse code brought a revolutionary change in long-distance communication. Before its development, sending messages across considerable distances was time-consuming and error-prone. Morse code streamlined communication by allowing messages to be transmitted quickly and efficiently.
2. Efficiency and Clarity: The simplicity of Morse code made it easy to learn and use. By encoding letters and numbers into sequences of short and long signals (dots and dashes), Morse code significantly increased communication speed. This efficiency was crucial in adopting telegraphy for important and time-sensitive messages.
3. Foundation for Future Developments: Morse's invention of a practical and effective communication system laid the groundwork for subsequent advancements in wireless communication. The

principles of encoding information into a binary format (short and long signals) served as a precursor to digital communication systems.

4. Digital Communication Paradigm: Morse code introduced the concept of encoding messages in a binary format, representing the foundation of modern digital communication. The transition from analog to digital communication systems, prevalent in today's wireless technologies, is rooted in Morse's pioneering work.
5. Cultural and Historical Impact: Morse code left an indelible mark on communication history and became integral to maritime and aviation communication and military communication during wartime. Even though its use has diminished with technological advances, Morse code remains a symbol of human ingenuity in the quest for efficient communication.

C. *Jagdish Chandra Bose* (Contributions done in the late 19th and early 20th centuries)

❖ Contribution:

1. Wireless Signal Generation and Detection: Jagdish Chandra Bose, an Indian physicist, made pioneering contributions to wireless communication during the late 19th and early 20th centuries. He conducted experiments in generating and detecting wireless signals, showcasing the possibility of transmitting electromagnetic waves without physical wires.

2. Development of Wireless Devices: Bose's work extended beyond theoretical exploration. He developed practical devices such as waveguides and horn antennas that enabled the manipulation and transmission of electromagnetic waves. His inventions laid the groundwork for wireless communication technologies.

Fig.3. Jagdish Chandra Bose [11]

❖ Impact:

1. Foundation for Wireless Telecommunication: Jagdish Chandra Bose's experiments and inventions were instrumental in laying the foundation for
2. Wireless telegraphy and radio communication. His demonstrations of wireless signal transmission and reception contributed to the evolution of technologies that eventually led to wireless telegraphy systems.

3. Anticipating Modern Wireless Technologies: Bose's visionary work anticipated the development of modern wireless technologies. His experiments showcased the feasibility of transmitting electromagnetic waves through the air, foreshadowing the ubiquitous wireless communication systems in our world today.

4. Scientific Legacy: Bose's contributions added a critical dimension to understanding electromagnetic waves and their potential applications. His work bridged the gap between theoretical concepts and practical applications, inspiring further research and innovations in wireless communication.

5. Cultural and National Pride: Bose's accomplishments as an Indian scientist in wireless communication have inspired generations of scientists and engineers in India and beyond. He stands as a symbol of innovation and scientific prowess, contributing to the broader narrative of scientific achievement.

6. Shaping Radio Communication: Bose's foundational work shaped the trajectory of radio communication and wireless technologies. His experiments provided insights into the propagation of electromagnetic waves, contributing to the development of technologies that revolutionized global communication.

D. *Harry Nyquist* (Formulated the Nyquist-Shannon sampling theorem in the 1920s)

❖ Contribution:

1. Nyquist-Shannon Sampling Theorem (1920s): Harry Nyquist, a Swedish-American engineer, formulated the Nyquist-Shannon sampling theorem, also known as the Nyquist theorem or Shannon-Nyquist theorem. This theorem established a fundamental principle for accurately converting continuous analog signals into discrete digital form.

❖ Impact:

1. Digital Signal Representation: The Nyquist-Shannon sampling theorem has profoundly impacted digital communication systems, including wireless technologies. It provides a crucial guideline for accurately converting analog signals, such as

voice or data, into a digital format that can be processed and transmitted digitally.

2. Wireless Communication Reliability: In wireless systems, where signals may undergo various forms of distortion and interference, the Nyquist-Shannon theorem's principles contribute to maintaining the integrity of the transmitted signal. The theorem's application ensures that the original signal can be accurately reconstructed at the receiver, even with noise and channel impairments.

Fig.4. Harry Nyquist [11]

3. Design of Wireless Protocols: Wireless communication protocols and systems heavily rely on digital signal processing techniques. The Nyquist-Shannon theorem plays a pivotal role in determining the appropriate sampling rates, signal bandwidths, and modulation schemes, optimizing the performance and efficiency of wireless networks.

4. Broad Applicability: The theorem's applicability extends beyond wireless communication to various digital technologies, including audio and video compression, medical imaging, and radar systems. Its foundational principles provide a universal framework for accurately representing analog phenomena in digital domains.

5. Quantization and Compression: In wireless communication, where efficient use of bandwidth is crucial, the Nyquist-Shannon theorem influences decisions related to quantization (the process of converting analog samples into digital values) and compression techniques that reduce the amount of data transmitted while preserving signal fidelity.

E. *Claude Shannon* (Developed the mathematical theory of communication in 1948)

❖ Contribution:

Mathematical Theory of Communication (1948): Claude Shannon's pioneering contribution to wireless communication lies in his development of the mathematical theory of communication. This theory, published in his landmark paper in 1948, introduced a systematic framework for understanding the fundamental principles governing information transmission and processing.

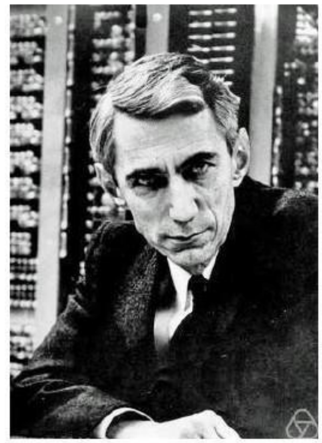

Fig.5. Claude Shannon [11]

❖ Impact:

1. Revolutionizing Communication Engineering: Shannon's theory marked a revolutionary shift in communication engineering. It provided a structured framework for analyzing communication systems, enabling engineers to assess the limits and capabilities of these systems quantitatively.

2. Optimization of Wireless Communication Protocols: Wireless communication systems rely on efficiently using the available spectrum, bandwidth, and power resources. Shannon's theory introduced channel capacity, which quantifies the maximum achievable data rate over a given communication channel. This insight guides the design and optimization of wireless protocols to achieve reliable and high-speed communication.

3. Error Correction and Channel Coding: Shannon's theory highlighted the inevitability of noise and errors in communication channels. This spurred the development of error-correcting codes and techniques that mitigate the effects of noise, ensuring reliable information transmission over wireless channels.

4. Information Compression: Shannon introduced the concept of entropy, which measures the amount of uncertainty or randomness in a signal. This concept laid the foundation for data compression algorithms that enable efficient storage and transmission of information in wireless communication systems.

5. Fundamental Principles of Data Transmission: Shannon's work elucidated the trade-off between

information capacity, bandwidth, and signal-to-noise ratio. This understanding has guided the development of modern wireless technologies, allowing engineers to strike a balance between data rate and signal quality.

6. Modern Wireless Systems: Shannon's theory permeates modern wireless technologies, including cellular networks, Wi-Fi, satellite communication, and more. His insights into channel capacity and coding schemes influence the design and implementation of communication protocols that underpin these systems.

7. Information Security and Cryptography: Shannon's contributions extend to information security. His work laid the groundwork for applying cryptographic principles to ensure the confidentiality and integrity of wireless communications.

IV. Future Directions:

The foundational principles introduced by scientists in the evolution of wireless communication continue to be pivotal in shaping the trajectory of future innovations. As we venture into the era of 5G, the Internet of Things (IoT), and beyond, the insights laid down by visionaries such as Fourier, Morse, Bose, Nyquist, and Shannon provide a solid groundwork for ongoing advancements.

1. 5G Revolution and Beyond: The fifth generation of wireless communication, 5G, embodies many of the principles established by these scientists. High-frequency modulation techniques, built upon Fourier's mathematical framework, allow the transmission of enormous amounts of data at unprecedented speeds. The Nyquist-Shannon sampling theorem remains vital in designing 5G systems, ensuring the accurate representation of signals in the digital realm. Shannon's information theory is critical in optimizing data rates and minimizing latency, leading to ultra-responsive networks at the core of 5G technology.

2. IoT Ecosystems: As the Internet of Things expands, Bose's experiments in wireless signal propagation gain renewed significance. The wireless sensors and devices that constitute IoT ecosystems rely on the wireless principles laid down by Bose, facilitating communication without the constraints of physical connections. The efficiencies brought about by

3. Nyquist's theorem enables these devices to sample and transmit data while conserving energy, a crucial factor for IoT's proliferation.

V. Global Impact

The global impact of wireless communication technologies is nothing short of transformative. The innovations arising from the contributions of these scientists have fostered unprecedented connectivity, transcended geographical boundaries, and enriched human interactions on a global scale.

1. Ubiquitous Connectivity: Wireless technologies have bridged geographical gaps, enabling instant communication and connectivity across continents and fostering a global village were information flows freely.

2. Cultural Exchange: Wireless communication has facilitated cross-cultural interactions, allowing diverse communities to share languages, traditions, and ideas, promoting mutual understanding and harmony.

3. Economic Growth: The seamless data flow has driven international trade, investment, and collaboration, contributing to economic growth by opening up new markets and opportunities worldwide.

4. Inclusive Education: Wireless technology has democratized education by making learning resources accessible to remote and underserved areas, breaking down knowledge and skill development barriers.

5. Remote Healthcare: Wireless communication supports telemedicine, connecting patients with healthcare providers regardless of distance, improving global medical access and health outcomes.

6. Emergency Response: Wireless networks are critical in disaster management and relief efforts, enabling rapid communication, coordination, and aid distribution during crises.

7. Humanitarian Aid: Wireless communication facilitates the delivery of aid to conflict zones and disaster-stricken regions, ensuring efficient distribution of resources to those in need.

8. Digital Empowerment: The proliferation of wireless devices empowers individuals with access to information, online services, and platforms for self-expression, fostering digital inclusion and empowerment.

9. Societal Resilience: Wireless technologies enhance societal resilience by providing communication channels even in remote or unstable regions, ensuring connectivity during challenging times.

10. Environmental Monitoring: Wireless networks enable real-time environmental monitoring, aiding in climate research, disaster prediction, and conservation efforts on a global scale.

Conclusion

Wireless communication has come a long way since its inception and continues evolving rapidly. The contributions of scientists such as Joseph Fourier, Samuel Morse, Jagdish Chandra Bose, Harry Nyquist, and Claude Shannon have been fundamental in developing wireless communication systems. Fourier's theorem is fundamental in signal processing and is crucial in wireless communication systems, enabling efficient transmission and reception of signals. The future of wireless communication is promising, with technological advancements and high-speed communication. Wireless communication will continue to revolutionize how we live, work, and play, and it will play a crucial role in intelligent infrastructures. As we move forward, it is essential to remember the fundamental beliefs and attitudes scientists share about their work and the nature of the world.

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Ms. Riya Modi is a final year student at Vidyalankar Institute of Technology, Mumbai, pursuing Biomedical Engineering to provide major contributions to global healthcare. She's an active member of the IEEE Bombay section, working to advance technology for humanity. She is actively involved in research and development of innovative technologies and has profound experience in technical writing. She aims to leverage her skills and to contribute to the broader scientific and medical community.

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The AT25KVD Kargil Expedition

HAMs High in the Himalayas

केनरा बैंक Canara Bank Together We Can

HEALTH NEXAA Innovating Health, Inspiring Trust

TAO DIGITAL Transformation Made Simple

Sawali Communications

1/15

OPERATORS

VU2CWB
Shoyon Titina

VU2HOT
Jagdish Bhat

VU2IVV
Jayesh Banatwala

VU2LOC
Shailesh Deshmukh

LOGISTICS SUPPORT

VU2BOT
Aditya Sawant

VU2TQC
Jayant Singh

PILOTS

VU2KIB
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A41LD
Waleed Al Zidjali

2/15

India celebrates Kargil Vijay Diwas (KVD) every year on 26th July to observe India's victory over enemy infiltrators in the Kargil War in 1999. As 2024 is the Silver Jubilee (Rajat Jayanti) year of KVD, the Indian Army's "Forever in Operations" Division of Integrated HQ, Ministry of Defence in coordination with the Wireless Planning & Coordination (WPC) Wing under Ministry of Communications, Govt. of India invited Amateur Radio Clubs to be part of the KVD celebrations.

The mission was to set up and operate HAM radio stations at a military location approx 14,000 ft (4,250mtrs) high in the Kargil area and spread the message as per the theme of KVD

Mumbai Amateur Radio Institute (MARI) VU2BPA, a most active amateur radio club from Mumbai, Maharashtra, enthusiastically accepted the invitation, sparking a wave of excitement as a core group of MARI Hams came together to meticulously plan and prepare for the upcoming adventure..

From left VU2HOT, VU2CWB, VU2IVV and VU2LOC

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Here is the story of Team MARI's mission, Kargil.

Team: 4 seasoned Hams confirmed their participation on the proposed dates
Dates: April 8th to April 19th
Logistics: it was decided to fly from Mumbai – Delhi - Leh and then by road to Kargil (approximately 225 km)
Gear: Survival outfits suited for high-altitude, challenging conditions of the Himalayan terrain with it frigid temperatures and rugged landscape was sourced.
Special Callsign: WPC allotted a special call sign **AT25KVD** to MARI for operating from Kargil.

Equipment Checklist

RADIO: ICOM IC-7300, ICOM IC-718
SWR METER: LDG, Daiwa
TUNER: LDG, MFJ
AMPLIFIER: FURUNO
MICROPHONE: ICOM-SM-50
ANTENNA: ENDFED 10-40M
COAX: LMR-400
HEADSETS: HEIL SOUND PRO 7
MAST: SPIDERBEAM
POWER SUPPLY: DIAMOND, SS-30DV
BANDPASS FILTERS: 4O3A
PATCH CORDS, ETC.

AT25KVD team making sure to pack the equipment for getting ready for the expediation

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Thrilling Operating Experience

Kargil is located in the Great Himalayas and is part of the Union Territory of Ladakh. This territory is the northernmost part of India near the Line of Control (LOC) between India and Pakistan. The area is known for its rugged terrain and stunning landscapes with snow-covered mountains and deep valleys.

MARI was the first club to operate from the operating location. Since the terrain and operating conditions were unknown, the team carried all types of radio gear to deal with every eventuality portable Masts, Long Wire Antennas, Bandpass Filters, Antenna Tuners, SWR Meters, Antenna Analyzers, Coax Cables, Power Supplies, etc., and, of course, Transmitters. All this required some heavy lifting as it weighed approximately 150 kg and was packed securely in specialized boxes/bags as it had to withstand the rigors of the journey.

Indian flag on Spiderbeam mast with Myantenna EFHW-4010 Multiband End Fed Half Wave Antenna

With its frigid temperatures and rugged landscape, Kargil provided a challenging backdrop for this unique amateur radio operation. It was set at approximately 14,000 ft (4,250 meters), where every breath was laborious, making every Phone DX contact rewarding for our efforts.

Due to restricted working hours, the team could work only during daylight, when bands were seldom open, and strong QSB when signals did reach.

We connected with the world from a makeshift shack in an actual stone-built bunker kept lukewarm in the snow by a kero heater on the mountaintop. The radio equipment, chilled by the sub-zero Himalayan air, buzzed with life as makeshift antennas' signals reached the mountainous horizon. Each contact made was a testament to the technical prowess and spirit of the amateur radio community. The message was spread to commemorate the cultural diversity in Kargil while saluting the gallantry of the people of Kargil and the Indian Army in defending the nation.

The breathtaking natural landscape of the Himalayan mountain range

The operation had its challenges. We battled harsh winds, sudden temperature drops, and the physical toll of high altitude. Yet, our dedication was unyielding, mirroring the unwavering determination of the armed forces for whom we came to honor.

6/15

Connecting with the World

We operated on the 10M, 12M, 15M, and 20M bands using our HF radio sets, utilizing simple end-fed wire antennas. These bands provided diverse propagation conditions, allowing us to make long-distance contacts and enhance our DXing experience. The end-fed wire antennas, despite their simplicity, proved highly effective in reaching stations worldwide, contributing significantly to our progress.

From left VU2LOC & VU2CWB operating from Indian Army bunker

Through 500+ QSOs, contacts were made with 60+ countries across continents, with each QSO (contact) contributing to the expedition's success. The radio waves carried more than callsigns they carried stories of bravery, remembrance, and the indomitable human spirit.

From left VU2HOT& VU2IVV operating from Indian Army bunker

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AT25KVD has made HF PHONE QSOs in over 60 countries
Argentina
Asiatic Russia
Australia
Austria
Bangladesh
Belgium
Belize
Bulgaria
Canada
Cape Verde
China
Croatia
Cyprus
Czech Republic
Denmark
Dodecanese
England
Estonia
Finland
France
Georgia
Germany
Greece
Hungary
India
Indonesia
Iran
Israel
Italy
Japan
Kaliningrad
Kazakhstan
Kenya
Lebanon
Lithuania
Netherlands
New Zealand
Norway
Oman
Poland
Portugal
Puerto Rico
Qatar
Romania
Russia
Sardinia
Saudi Arabia
Serbia
8/15

AT25KVD has made HF PHONE QSOs in over 60 countries


Slovak Republic


Slovenia


South Africa


Spain


Sweden


Switzerland


Tajikistan


Thailand


Turkey


Ukraine


UAE


United States


Uzbekistan


West Malaysia

Conducting daily health checks is a crucial responsibility shouldered by the Indian Army

9/15

Mounting End-fed 10-40M antenna with Spiderbeam mast

Kero Heater

AT25KVD team operating from Indian Army bunker

10/15

Educational Outreach & Collaboration

Live demo with JNV students

The expedition, coordinated with the Indian Army and supported by various organizations, also served an educational purpose.
It provided real-time lessons in geography, physics, and communication technology to schools and university students and aimed to spread awareness about the amateur radio hobby.
It was very gratifying to see the students' faces filled with thrill and fascination when they had the practical experience of listening to QSOs.

Jawahar Navodyaya Vidyalaya (JNV), Khumbathang, Dist. Kargil was established in 1988, about 27 km from the District Headquarters in Baroo.
The school is a fully residential, co-educational school affiliated with CBSE, New Delhi, with classes from 6 to 12 standards.
It is surrounded by hills and a lush green valley on the banks of the Suru River, which gives it a stunning and scenic look.

JNV School Campus

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The University of Ladakh was established in 2019 and is the only trans-Himalayan Institute of higher learning and research. The university has campuses in Leh and Kargil; and 6 constituent degree colleges.

University of Ladakh students are attending the presentation on Amateur Radio

University of Ladakh campus

12/15

Reflections at High Altitude

As the expedition wrapped up, we took a moment to reflect on our experiences against the majestic silence of the Himalayas. We had set up a successful radio station and gained firsthand knowledge of operating in one of the most challenging environments on earth. We also fostered a deeper connection between the amateur radio community and the proud legacy of Kargil's heroes.

AT25KVD, QTH - Indian Army bunker at morning

We will be ever grateful to the Indian Army for hosting us, to the people of Kargil for their warmth, and to the HAM community for responding to our call.

AT25KVD, QTH - Indian Army bunker at evening

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AT25KVD Team

Safe & successful expedition return of team AT25KVD at Mumbai airport

14/15

THANK YOU

We can only achieve success with the support of our local HAM OM VU2YYE Jaideep Chanda. We want to express our special thanks and gratitude to VU2YYE, who supported and contributed to our successful Kargil expedition.

VU2YEE is currently located in one of the rarest grids in India (MM74xj). He endeavors to manage his busy schedule while attempting to operate on all the modes.

From left VU2HOT, VU2YYE, VU2IVV, VU2CWB AND VU2LOC at VU2YYE shack

We extend our special thanks to the organizers of this expedition, whose meticulous planning and execution made our success possible.

- **Ministry of Defence, india**
- **Indian Army**
  - **Forever in Operations Division**
  - **Corps of Signals**

- **Ministry of Communications, Govt. of India**
  - **Department of Communication (DoT)**
  - **Wireless Planning & Coordination (WPC)**

15/15


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Magzine Editor: Carmelito Andrade (VU3FUD) - Printer: Olive Prints, Loutolim, Goa. 9403818136