



MTT-S Society News

The IMaRC 2015 MTT-S SIGHT Special Event Amateur Radio Station

■ James C. Rautio

What do you mean you want to be an engineer?"

My father could not believe what I had just suggested. He continued, "I'm a farmer. My father was a farmer. His father was a farmer. No one in our family has ever gone to college. And where do you ever think we're going to get the money to send you to college? Money doesn't grow on trees, you know. And besides, why do you have to go to college to drive a train?"

OK, I did add that last sentence just for fun, but the rest of the dialog accurately describes the environment I grew up in.

My Road to RF

My father had emigrated from Karelia (at the time, part of Finland) as a small child; his family was escaping the



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Russian revolution. Here in the United States, he managed to graduate from the seventh grade. Somehow, he learned how to make transmitters and receivers from scavenged and discarded electronics, and he got a ham radio license.

Then World War II shut down his ham radio activities.

As a youngster in the 1960s, I saw all his electronic junk in the "radio room." I developed an intense curiosity about how it worked.

With my father's help, I gradually learned about it and managed to get my ham radio license (Figure 1). On the left in the photo is the top portion of the transmitter my father built, and which I often modified. I still remember every detail of that transmitter.

All that electronic stuff had piqued my interest. It was a very roundabout route, but I did manage to overcome the obstacles my father had accurately pointed out and get a college degree. I even went on for my master's and Ph.D degrees. After working in industry for a while, I started a company, and it has been a wild ride ever since.

If, in those days back on the farm when I was driving a tractor and pitching hay, someone had told me what would happen, I would never have believed it.

"Runner Down!"

Fast forward a couple decades. I am part of a team providing communications for a high school invitational cross-country meet (a 5-km foot race through fields and woods) with several thousand runners.

"Runner down!" a sprinter in the group passing me shouts.

"Where?" I see no problem back down the trail behind them.

"Two hundred meters back," the runner shouts again as he disappears out of sight.

I key my handheld transceiver. "Net Control, this is Checkpoint 8. Runner reported down somewhere near the beginning of Trail 3."

"Roger, Checkpoint 8. EMT being dispatched to Trail 3 entrance. ETA three minutes."

"Roger, Net Control. I'm also proceeding to beginning of Trail 3."

When I get there, a runner is indeed down, agony sweeping across his face, his ankle twisted. What to do? I had first-aid training back in the service, but something else—natural childbirth

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classes a few years earlier—comes to the rescue.

“OK, buddy. Try to relax. We have an EMT coming pronto.”

I place my index finger in the palm of his hand. “Squeeze my finger. That’s it. Squeeze as hard as you can. Focus on squeezing my finger. Nothin’ but squeeze!”

Almost immediately the EMT arrives driving an all-terrain vehicle. As she dismounts, she smiles, recognizing instantly what I’m doing. “Thanks,” she says.

“Looks like RICE in his future,” I comment—“RICE” being short for “rest, ice, compression, and elevation,” the standard treatment for a sprain or strain.

“Yes, it does look that way. Now, how we doing, little fella? ...”

MTT-S SIGHT Amateur Radio Objectives

These stories illustrate the two objectives of the Microwave Theory and Techniques Society (MTT-S) Special Interest Group on Humanitarian Technology (SIGHT) sponsorship of amateur radio at last year’s International Microwave and RF Conference (IMaRC 2015).

The first is to promote interest in science, technology, engineering, and mathematics (STEM) fields and, specifically, in MTT-S-related topics. For any community to reach higher levels of development, a strong STEM base is an absolute requirement. Promoting amateur radio is one way to do that. In many countries, this is going on as we speak. For example, there are more radio amateurs in the United States today than at any time in history.

The second objective for MTT-S SIGHT sponsorship of amateur radio is to promote interest in building a strong, widespread, volunteer-staffed, and completely self-funded emergency communications infrastructure. For example, during the 2013 Boston Marathon bombing, there were already hundreds of fully trained radio amateurs everywhere. And, immediately after the bombing, amateur radio was the only communications that still worked. Thanks to radio amateurs, within minutes, every runner in the field knew the race had been canceled.

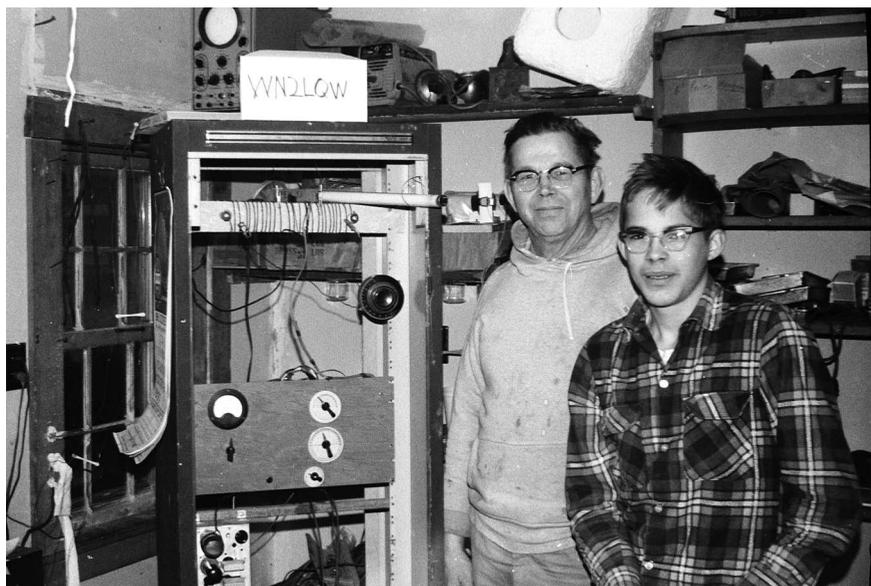


Figure 1. My father and I in 1969, just after I received my first ham radio license. To the left is the transmitter he built prior to World War II. This and all the other electronic “junk” he had accumulated sparked an intense curiosity that eventually led to my career as an electrical engineer.

As for police and fire radios, the fact that everyone had to get through meant that no one could get through. Cell phones were completely useless.

Amateur Radio as a Motivation to Engineering

Otherwise destined to become a farmer, I was led in another destination by technology, in the form of amateur radio. In India today, there are probably a few million young people with stories that start like mine—only without amateur radio. How will these stories end? One of the best ways to insert the lure of technology into the life stories of these millions of energetic, inquisitive young adults is through amateur radio.

The one thing we never, ever want to do is to tell young folk, “If you like science and math and hard work, engineering is a good field for you.” We lose a few kids with “science,” a lot more go elsewhere when we mention “math,” and then only a very few hardy masochistic souls are left when we point out the “hard work.” Very bad way to promote our field.

Rather, we should start with the result. For example, we can maybe show kids how to build their own super-fast computers to save money and play more

exciting video games. Or make neat gadgets with 3-D printing. Or introduce them to ham radio. Get our kids excited about what they can and want to do—then, only later, say, “Oh, by the way, you can do even more amazing things if you learn this little bit of really easy math, say, to make a dipole antenna...” and build from there.

Ham radio is the option that we focused on at IMaRC 2015. I, personally, claim very little credit for this endeavor. It was a team effort.

On the MTT-S side, Dr. Tim Lee, immediate past president of the MTT-S, has been exceptionally energetic in promoting MTT-S SIGHT activities, especially amateur radio. Dr. Ajay Poddar (call sign “AC2KG”) was instrumental in getting the right resources in the right places at the right times (no small task!) in coordination with the conference chairs, Dr. Alaa Abunjaileh and Dr. Lakshminarayana Merugu. Mr. Tushar Sharma had some key contacts in India and helped me make the right connections. As for me, I just got the ball rolling.

And, wow, did that ball roll! Tushar personally knew one of the most famous amateur radio operators in the world, Ms. Bharathi Prasad (“VU2RBI”) from New Delhi. She, in turn, connected

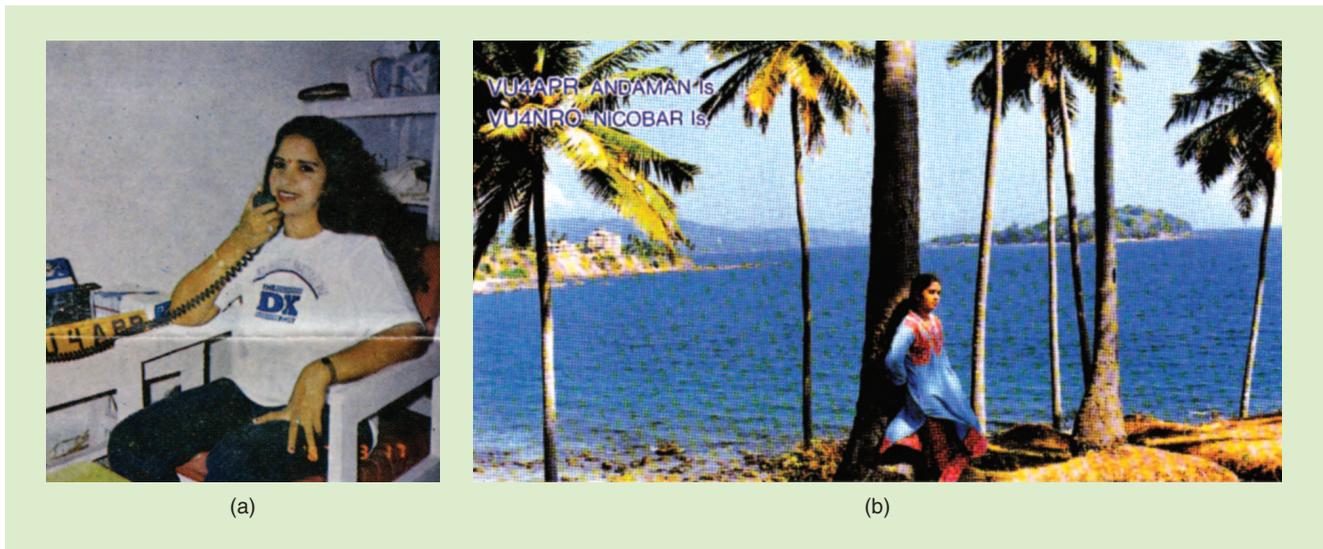


Figure 2. (a) Bharathi Prasad operating during the first DXpedition to Andaman Island, in 1987. (b) A QSL card confirming a ham radio contact from Bharathi.

me with the National Institute of Amateur Radio (NIAR) in Hyderabad (“VU2NRO”), in the persons of Mr. Ram Mohan (“VU2MYH”) and Mr. Jose Jacob (“VU2JOS”).

Help from a World-Famous DXer

Why is Bharathi so famous? One of the most popular activities in amateur radio is called “DXing.” Formally, DX is an abbreviation for “distance,” but DXing means contacting stations at large distances. For high frequency (HF, i.e., 3–30 MHz), this means making contact with different countries. DXers like to contact as many DX countries as possible. I have been a DXer since 1968,

and I actually have confirmed contacts with all the countries in the world. (Yes, it took a while to accomplish.)

One of those contacts was with—you guessed it—Bharathi. Figure 2(b) shows the QSL card (a card sent to confirm in writing that the contact was indeed made, often used to receive various awards) from my first contact with her—or, more likely, from a member of the team she organized to activate Andaman Island in 1987. (Andaman is an island in the Indian Ocean. It is part of India but far enough away from the mainland that, for amateur radio purposes, it counts as a separate country. We have a similar situation in the

United States, where both Alaska and Hawaii count as separate countries.)

There are no active amateur radio operators living on Andaman Island, so a special “DXpedition” is required if any contacts are to be made. This, in turn, requires lots of permissions from one of the world’s most intricate bureaucracies. And lots of money to get all the operators and equipment there and back again (mostly covered by donations from grateful hams). And a ton of planning.

Bharathi organized just such an expedition. Tens of thousands of hams around the world wanted to make a quick contact, all at the same time. To the untrained ear, it was absolute chaos—but all part of the DX game. Fortunately, the DXpedition was active for several weeks. With considerable effort, I managed to get through the “pile up” and make a contact. So exciting!

Amateur Radio During a Disaster

Fun and games. That’s nice. But of what use is it?

This was made crystal clear on 26 December 2004 at 00:58:53 UTC when the Indian tectonic plate suddenly slipped 15 meters further under the Burma plate off the coast of Sumatra. This sudden motion launched a wave, a tsunami. In the next few hours, the resulting tsunami snuffed



Figure 3. Mr. Suri (“VU2MY”) providing an introduction to amateur radio at the very well attended IMArc 2015 amateur radio panel session.

out an estimated 230,000 souls in 14 countries and displaced 1.74 million people. Incredibly, at this very moment, Bharathi was in the middle of yet another DXpedition, again on Andaman Island, right in the center of things. I'll let her tell the story in her own words:

It was almost 6:30 a.m. I had been up for 18 hours and was working Indonesia and Thailand on 80 meters when my hotel room, on the fifth floor, started shaking. Terrified, I ran downstairs and outside, shouting for several friends to come along. Almost immediately, I saw the tsunami rush on shore. Fortunately, it did not reach us. Because the tsunami happened immediately with the earthquake, I knew we must be close to the epicenter. The shaking continued, it seemed like forever. Everything was moving. When it finally stopped, my DXpedition friends and I gathered together. We had all survived.

It had taken 17 years to get all the required permissions for this operation. Permissions from the Defender Home Ministry, the Defense Ministry, and the External Ministry were difficult to get, but it was finally given. We could not get permission to operate from nearby Nicobar Island, or any other islands in the area. Electricity was out, long term. Since we had not planned on emergency operation, we had no backup power supply. But being hams, we are very resourceful, somehow creatively making do with whatever we might have. The army, located nearby, turned out to be our greatest friend. They lacked sufficient communication gear, but they had plenty of batteries and generators. They eagerly supplied us with everything we needed. The DXpedition operation was immediately terminated, and we switched to emergency communications on 7.090- and 14.195-MHz HF for long haul and 145.000-MHz VHF for local work (all simplex, there was

no repeater). We split the team up, with the army providing air transport to hard-hit Carnicobar Island (two stations) and by ship to Hutbay, Camelbay, and Teresa Islands. We maintained three stations on Andaman Island. Somehow, permissions to operate were given almost instantly.

Emergency operations went on for an entire month. The army, the hotel, and the people at all of our

station sites were extremely helpful. But, best of all, we were able to help many people during this tragic event. And, almost as a side note now, prior to the earthquake, we had already completed 35,500 DXpedition contacts with hams from around the world.

My own story of the downed runner, in a very tiny way, and Bharathi's story, in a huge way, illustrate the second goal of MTT-S SIGHT: to promote interest



Figure 4. Bharathi explaining amateur radio to an attentive group of college students. The MTT-S membership booth is in the background.



Figure 5. From right, Jose and Mohan explaining amateur radio to interested students.



Figure 6. Bharathi (right) suddenly handed the microphone to me as many participants looked on.



Figure 7. The QSL card we are sending to stations requesting written confirmation of contacts with “AU2MTT” shows scenes from the conference.

in building a strong, widespread, volunteer-staffed, and completely self-funded emergency communications infrastructure.

There are only a few active amateur radio operators in India. With large numbers of trained and equipped operators, no matter where a natural (or intentional) disaster happens, there will be operators ready to provide immediate emergency communications: not people who must travel to the location, have their equipment and supplies flown in on large pallets, and, somehow, in all the chaos, transfer everything to a remote disaster

location; no, people right there on the ground, ready to go, instantly.

Lofty goals. It will be a long journey.

Amateur Radio at IMaRC 2015

A first step (for the MTT-S, at least) was taken last December at IMaRC 2015. With Bharathi’s help, I contacted the NIAR and, after obtaining permission from the conference cochairs and a venue from the conference hotel, the people there organized everything. First, the conference chairs generously donated prime time in their largest venue for an amateur radio panel session (Figure 3). Of course,

we had Bharathi speaking on emergency communications. Mr. S. Suri (“VU2MY”), founder and chairman emeritus of the NIAR, provided an introduction to amateur radio. Mr. S. Ram Mohan, executive vice president of the NIAR, spoke on digital HF/VHF communications. Mr. Sanjay Nekkanti (“VU3ISS”), general committee member, and NIAR Director Dhruva Space spoke on satellites and ballooning. About 150 people attended, making it one of the best attended sessions at the entire conference.

This panel session meshed well with a SIGHT student design contest and an illustrious SIGHT panel session, both organized by Ajay and described in detail in the accompanying column. I personally helped judge the student design contest. There were some fantastic projects showcased there. It is clear that these kids really care. These other SIGHT activities were also sponsored and actively supported by the IEEE Antennas and Propagation Society.

The NIAR also set up the special event station, “AU2MTT.” (Call signs beginning with AU or VU are, by international treaty, allocated to India; the other part is a specially assigned call in honor of the MTT-S and the conference.) Operation started two weeks before the conference. Then, the station was moved to a booth in the exhibit area and was operated during the show. More than 1,000 contacts were made by Bharathi as “VU2RBI,” and more than 400 more by Jose as “VU2JOS.” Most contacts were with Asia and Europe (a solar coronal hole active during the show disrupted the ionosphere and made contacts with North America difficult).

Because of Ajay’s SIGHT student design contest, we had a lot of college students attending the show. A special reduced registration fee was also provided for students, with many attending from local colleges and universities. Small groups regularly came around to see the ham radio station in operation (Figures 4–6). Several groups made multiple visits. You could actually see the excitement in their eyes.

Figure 7 shows the QSL card we are sending to those requesting a written confirmation of a contact with "AU2MTT." QSL cards can be submitted to various organizations to receive awards. One of the most coveted is the DXCC, given for confirmed contacts with 100 or more countries. Notice that the MTT-S and IEEE logos are prominently shown as sponsors of this special event station.

The lower right image on the QSL card in Figure 7 is a photograph of Mrs. Bhamumathy operating. She is quite a lady, and a very active amateur radio operator. In fact, she was a huge help to the NIAR in assisting my application for a reciprocal Indian ham radio license. Of course, the usual bureaucracy was slowing the process to a crawl. So, at one point, she got on the phone to an unfortunate government official and really lit into him, big time! Then, she handed the phone over to Mohan, and the hapless government official timidly asked, "Who . . . who was that lady?" With her help, the NIAR's help, and Bharathi's help, I did receive my license: call sign "VU3MTT" (Figure 8).

Putting Goals into Practice

Even as we talked to the students, there was major flooding devastating the Chennai region of India, to our south. Amateur radio was effectively the only communication into the disaster area. I told students to imagine the building we were in being flooded—just like the pictures on television of the Chennai floods. No way in or out. No cell phone. No telephone. No food. No electricity. No water. What would you do?

Usually, someone would point to our ham radio equipment and ask, "How do you run that with no electricity?"

"Very good," I'd say, smiling. "You're thinking ahead. That's important. For disaster communications, we need to be able to operate independently of commercial power: generators (and we need fuel for them, too), solar power, wind power, fully charged batteries, and so on. That is a big part of ham radio. In fact, in the United States and other countries, we even have weekend-long contests where everyone



Figure 8. The NIAR guided my application for a reciprocal Indian amateur radio license through the bureaucracy . . . with some additional help from Mrs. Bhamumathy (pictured on the lower right in Figure 7).

tries to make as many contacts as possible, all for fun and all without any use of commercial power or pre-existing radio facilities. We get our equipment ready to go, then set it all up in an empty field or some such, and then operate like crazy all weekend."

The excitement in their eyes was amazing! I could just see these kids converging on an empty field, raising antennas, and starting up generators in a few hours' time. And note carefully: not once did I mention math or hard work (and there is lots of hard work involved in putting together and running one of these weekends!). Heck, just like Bharathi's DXpedition to Andaman Island, all this stuff is fun!

I told students to imagine the building we were in being flooded—just like the pictures on television of the Chennai floods.

I have visited a lot of universities over the last three decades. One thing I have seen more recently is that, while students are indeed still very interested in getting jobs, they now also very much want to make a difference, to benefit humanity, to make the world a better place. If you want to get a student or young professional interested in your company, or in our profession, or even in our MTT-S,

offer him or her a chance to make a difference. Making a difference is something we can do in a major way. All we have to do is let young people know that.

And that is what we were doing at IMaRC 2015.