Technical Monitoring at the Voice of America

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International broadcasters have spent a great deal of time and money, over many years, understanding and predicting how to transmit their signals via the ionosphere to the area they want them to 'land'. This they can do with a high level of certainty, but even with all the study and computer modeling, there are still questions that have to be answered.

These questions are central to the purpose of all broadcasters, but have particular significance for international shortwave broadcasts. Did our signal really get to the other end; how well was it received; was there interference, and from whom; how well did my signal do yesterday, and how well will it do tomorrow?

TECHNICAL MONITORING

Technical monitoring attempts to answer these questions and is the feedback loop in a circuit that originates in studios, goes through transmitters, and ends with listeners far away. By evaluating the signal in or near listeners, technical monitors can determine if and how well the broadcast was heard.

I was in charge of monitoring at the Voice of America (VOA) from 1987 through 2020 and in this article I would like to share how we used technical monitoring in an attempt to 'close' the open loop of shortwave propagation. What follows is a description of the development of technical monitoring at VOA from its beginnings to the present day.

Technical monitoring at VOA relies on experienced human monitors listening to and rating reception samples using a numerical code and comments. The system used to rate reception is called SDO (Signal strength, Degradation, and Overall merit). It was in use at VOA when I arrived in 1982 and I believe it was developed long before that. It is similar to systems used by radio listeners and amateur radio operators or hams all over the world.

The most useful feedback from experienced monitors includes identification of the problem (propagation, interference, modulation, etc.), their suggestions for a cure, and timely feedback after changes to the transmission have been made. There is no way to automate the judgment of these monitors, and I feel privileged to have worked with so many experienced and talented monitors during my career at VOA. Without them, our various technical accomplishments would certainly not have been possible.

I joined the Frequency Division of VOA in March 1982 as a Foreign Service Monitor, destined to be posted to Islamabad in Pakistan, after learning how things worked in Washington. It was a great time to be working at VOA as President Reagan had increased VOA's budget to enhance our reach and influence in the Soviet Union and elsewhere. This decision had a significant effect on the engineering side of VOA, in what was referred to as VOA's 'modernization', leading to increased staff, new projects, new construction, and new opportunities. I never got posted to Islamabad, but I did travel a lot during the next several years, including a trip to Central America where I met my wife.

When I took over as head of monitoring in 1987, we were on the cusp of technological improvements that would change the way many jobs were done across all fields. Laptop computers, handheld data entry devices, and the internet were just some of the developments that would change forever how monitoring was conducted.

Monitoring at VOA was organized around technical monitoring offices (TMO). They were a combination of a US Foreign Service Officer and local employees, who were employed full-time to monitor the broadcasts from VOA, and those of our competitors, and conduct periodic reception surveys of the region. The number and locations of TMOs changed over time but the ones in operation when I came on board included Vienna, Helsinki, Belgrade, Nairobi, Islamabad, and Hong Kong. In addition to TMOs, VOA was one of the first international broadcasters to pay individual enthusiasts, once they demonstrated their expertise and reliability, to monitor broadcasts. For lack of a better term, we called these radio experts Contract Monitors (CMs). Other broadcasters mostly relied on letters from listeners and hobbyists (SWLs and DXers) for anecdotal evidence.

Almost all monitoring data came to us on hand-written forms and we often had to wait for weeks for two staff members to key them into a mainframe computer for analysis. Since the aim was to improve VOA reception in the target area by getting feedback as quickly as possible, waiting weeks was not ideal. Without email or internet, we relied on telegrams from US Embassies and written forms sent in the Diplomatic Pouch. Telegrams were received within a day or so, but were limited in content; messages sent via the Pouch often took weeks to arrive. It was evidently essential to receive and process the data much faster and more efficiently.

Our first attempt at streamlining data entry was through the use, by our monitors, of Scantron forms. Like barcodes, these forms eliminated the need to manually key in data and reduced our backlog to near zero. But it still took weeks to get the forms from the field to Washington, and scanning by our staff produced a high error rate. Fixing those problems would depend on another technological breakthrough.

REMOTE MONITORING

Sometimes numerical SDO scores, no matter how heavily annotated, didn't accurately convey audibility. I began to ask, "What if we were able to let people hear short audio samples of real reception as experienced by real listeners in distant target areas?" Coincidentally, our colleagues at the Federal Communications Commission (FCC) had designed a system, based on a 'coherent modem', that divided the normal phone line spectrum between data and voice. This revolutionary system allowed users to tune a remote radio, and listen simultaneously to the received signal over a phone line. It was the start of the remote reception which is now used by DXers.

A real test of this new system came when the Tiananmen Square protests in April to June 1989 led the Chinese government to re-start jamming of VOA Mandarin broadcasts, after an absence of such activity for more than a decade. After some negotiating we succeeded in borrowing an FCC remote receiver, and shipped it to Beijing. The Embassy connected it to a phone line, and I raced to work each morning to hear what our signals and the jamming sounded like live in Beijing.

Inspired by this success, we began working on our own method of retrieving remote sound samples although, initially, without real-time capability. Within a few months we developed a Remote Monitoring System (RMS) with the unlikely components of a Macintosh computer, a HyperCard, a Buffalo Box splitter, and a RealAudio encoder. With this kit, we collected sound samples on a scheduled basis and saved them for later download by modem. We replaced the FCC system with our own in 1991, beginning our journey towards having as many as 75 RMSs worldwide. This necessitated, however, a new way of collecting, managing, and analyzing the large amount of data thus produced.

NEWTON

In August 1993 I attended the MacWorld Boston conference where Apple introduced the Newton MessagePad, and the acronym PDA (Personal Digital Assistant) entered the lexicon. With the Newton and the right software, we could replace paper forms and the Diplomatic Pouch with an app and modem transmission to Washington.

As part of the Newton introduction, Apple enabled companies doing software development to meet potential customers. One vendor was AllPen Software from Los Gatos, CA. Over the next several years, we worked with AllPen and their developers to create a monitoring data-entry system and many other exciting projects. The Newton-linked software they developed allowed us to send schedules to monitors, and for monitors to import observations into a database.

Following the dissolution of the USSR in 1991, the US Government examined which Cold War organizations could be disbanded – the so-called 'peace dividend'. Radio Free Europe/Radio Liberty (RFE/RL) was one of those organizations. As RFE/RL's assets were divided up in 1995, VOA inherited a network of relay stations, and more than a dozen monitors in the former Soviet Union. By this time our Newton data entry app was ready, and we were able to introduce it to these monitors at a meeting in St. Petersburg.

In 1996 the British Broadcasting Corporation (BBC) privatized the frequency management and relay station operations of its World Service transmissions. These operations were taken over by a new firm called Merlin Communications. As part of their contract Merlin had to demonstrate 'delivery' of their radio signals to as much of the BBC's listening audience as possible. In order to accomplish this, Merlin came to VOA for help with remote monitoring. Under its current owner, Encompass Digital Media, it remains a supportive partner in our monitoring efforts.

By 1998 VOA had 20 RMSs around the world, but dialing them up to retrieve sound recordings remained time-consuming and expensive. To address this and other issues we developed RMS II. We changed receivers to a Drake R8, replaced the outboard modem with a PCMCIA card on a Mac PowerBook, eliminated the need for an external box for digitizing sounds by moving to the built-in QuickTime encoder, and developed a C++ program to run the whole system. We also moved to using local Internet Service Providers (ISPs), where available, to automatically send sound samples every 30 minutes and, a new feature, bandscans back to Washington, all at local phone rates. Incoming data was handled by a Librarian application that collected the data and made it available on a webpage.

With RMS II and Librarian, we largely automated the collection and management of sound samples. But we still weren't doing anything with the samples other than collecting them and making them available for listening. As live monitoring duties began to decrease for some monitors, we began feeding them a folder of RMS sounds and asking them to use something called MacRater to SDO them. This was like live monitoring of off-air broadcasts but shifted in time and space. We might, for example, have a monitor in Poland rating RMS samples from locations in Africa.

To manage and analyze the growing volume of monitoring, we developed the Frequency Management Database System (FMDS). It not only handled incoming SDO observations from the field but automatically sent out new schedules to the RMSs on a nightly basis.

With these new features we had a nearly self-sustaining ecosystem. We could now collect reception samples from all over the world, rate them, combine them with 'live' monitoring into a database that could be queried in many different ways, and modify RMS scripts to collect new sound samples based on our own and other broadcasters' input.

WEBMONITORING

In 2001 we began receiving reports that people inside China were unable to reach VOA's Mandarin language service webpage. Since we already had RMSs inside China, and in order to remain relevant to VOA's mission, we designed a capability called WebMonitoring. During specific times we could tell our RMSs to try and 'hit' URLs and, if they were unreachable, to run a traceroute to see how far the requests were getting before being blocked or timing out. Since we were using local ISPs for our connection to the internet, it was as if we were a local internet user. As far as I'm aware, we were among the first to confirm that viewing of certain webpages from within China was consistently blocked.

RMS MEETS SDR

By 2007 we had run the course of using traditional receivers, primarily the Drake R-8 and the Icom R-71 series, for our RMS. Working with a developer, we designed a new RMS based on Python scripts and an SDR-IQ receiver. A new version of Librarian was also developed to run on a Google Cloud Platform that was scalable enough to handle the entire RMS network and automate the distribution of RMS sounds for monitors to rate.

My last big technical project at what had by then become the US Agency for Global Media (USAGM) was an iPad Rater to replace our aging Mac, Palm, and Newton-based systems for data entry. It is essentially a combination of the 'live' rater system that ran on Newton and Palm devices and the RMS rater system that ran on Macs. This system can now rate both sounds from RMSs and live signals heard on a radio. It features improved graphics, automation of sound distribution for rating, and some auto-filling of form entries based on previous reports.

Though human monitors remain critical, we had automated their workflow. We had closed the 'open loop' many international broadcasters operated under for decades, and we were able to answer the question, 'Are we being heard?' in many of IBB's most important target areas, within minutes of the program being broadcast.

Technical monitoring of direct broadcast radio signals continues at the USAGM. And while there are now other ways, besides shortwave, to get the message across, nearly all involve gatekeepers. They may require monitoring, too.

Bill is an active MW DXer visiting Lubec, Maine and Grayland, Washington twice per year on DXpedition. His interests include radio wave propagation, antennas and bird watching.