

Send A High Quality Audio Feed From Anywhere

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ABSTRACT

Distribution of audio from the field to the studio has changed dramatically over the year. There was a time when live audio was only available over a POTS line or it was hand-carried back on tape for playback. Yes, time have changed, and many of us that have been in engineering for over 20 years can attest to the changes as we were there 'making them happen' with each new technology. A review of technologies evolution is not the aim of this paper, to a certain extent; it cannot be helped as technology used decades ago is still in use today and continues to help us accomplish our mission. This paper is a real-life case study of how we send and receive audio from our affiliates around the globe and how you can do the same, sometimes cheaply or free. With limited budgets and smaller engineering staffs, we hope you will find some nuggets of value here and hope the next time we meet that you will have more advice for us as we all continue to learn from each other at conventions like the NAB.

From Turkey, to Cambodia to Nepal, the mainstay of transferring audio to Radio Free Asia's Master Control Center in Washington DC is the Internet. File Transfer Protocol, or FTP, does the bulk of the work from our reporters, while there is still reliance upon phone calls from overseas to the United States in order to feed approximately 10% of the reports we broadcast. Here are the results from 2008:

RECEIVED BY	
Phone	2705
ISDN	0
FTP	23,355
Total	26,060

Figure 1: Audio feeds to Master Control in 2008

Transmitting a live call-in show on the air from a 300 room hotel in a third world country that only has a total of seven outside telephone lines and suffers from daily power outages or, establishing a Voice Over IP (VOIP) connection where your 64K dialup constitutes half of a town's entire bandwidth can create a challenge or two.

While most of you may not face such austere condition, solutions that are geared towards working with 'next-to-nothing' can be insightful when working under optimal conditions. This paper will also examine software and gear we use, and have used, along with a review of its performance, even under difficult.

INTRODUCTION

A radio engineer's job is to provide, or at least help to provide, the best quality audio using the most reliable delivery systems available. These days, no one has limitless budgets, so we are forced to live without the turnkey systems and scramble for the next best thing. This can be difficult when you have been given a special event to cover with very little prior notice. Radio engineers 'earn our keep' through innovation, teamwork, begging, borrowing and a great deal of schmoozing. Your tenacity and creativity will many times 'save the day' when the challenge of audio from someplace outside your main studio seemed impossible.

We do not pretend to have all the answers you will need in your career, but we do hope to inspire your imagination and hope you will be writing the next NAB paper the rest of us will use as our future guide. In the 13+ years our company has been around, we have evolved in most everything we do. Everything from recording, to editing, archiving, even the use of the phone lines (POTS, ISDN, T1, T3, etc) to the audio gear and how it is distributed throughout our facilities has dramatically changes since we first went on the air in 1996.

ABOUT RADIO FREE ASIA (RFA)

RFA broadcasts news and information primarily by shortwave to listeners in Asian countries where full, accurate, and timely news reports are unavailable or suppressed. Established by an act of Congress in 1996 RFA is a private, non-profit corporation. Worth noting, RFA also has to FM affiliates in Cambodia and are the most used frequencies for our Khmer listeners.

RFA is heard in Burmese, Cantonese, Khmer, Korean to North Korea, Lao, Mandarin, Tibetan, Vietnamese and Uyghur. Native speakers make up the majority of each language service, whose distinctive programming reflects each of these unique cultures.

DISCLAIMER

In this paper, specific equipment and software is mentioned by manufacturer and model number. This should not be considered as either an independent review or a product endorsement on the part of RFA or the authors. Over the years a great number of different products were used and are still in use at RFA. For the sake of brevity, all products that have been or are still in use could not be covered in this paper.

Likewise the omission of any products should not be misconstrued to represent a non-endorsement by the authors. Generally we use what we have based on budgetary constraints. When products are mentioned it serves as both a historical note and a means to give you access to specifications that might aid you when researching comparable equipment.

CHALLENGES

Transferring audio reports to and from the main broadcast facility by nature can be considered a challenge for all reporters at one time or another. This is when we see the presence of Murphy's Law take over raise everyone's blood pressure; what can go wrong, will go wrong! At times it will seem that nothing works as planned. As an example, a reporter had flown from the East Coast to the West Coast for a 'chance of a lifetime' interview. When the interview was over, the reporter attempted to playback the interview on their mini disc recorder and there was no recording on the disc. Since then, the reporter has insisted on having two audio recorders and they roll both during every interview. Since then though, they have never had one problem with either recorder. Experience is a valuable tool, but it can also drain your resources. Imagine having 150 reporters to support but also having to purchase extra recorders as insure no interview is ever lost; we could not afford to do that and we assume you cannot either.

When we are supporting a live broadcast from remote location, we try to adhere to the general rule of thumb that all broadcast technicians follow for any live remote; bring twice the equipment you think you need and then some. Unfortunately, the technical infrastructure of the broadcast location itself creates all the challenges you will ever need. In other cases there is an issue with the level of press access RFA is granted. As a surrogate broadcaster, RFA is at times discouraged from attending events that are either held

in, or that involve one (or several) of the countries where we broadcast. It bad enough to have the local car dealership angry because of a new report you aired about their cheating mechanics, but imagine having to work in a country where the government does not like you.

Other locations can become a self-inflicted challenge due to physical location, infrastructure, budget and time limitations. In these cases a reporter or a technician is generally adjusting 'on the fly' with a last minute notice and a suitcase of whatever gear could be cobbled together. The following sections will examine these challenges in more detail and offer a few work-arounds.

INFRASTRUCTURE CHALLENGES

Infrastructure challenges can best be described as finding the expected telecommunications and utility services at a venue are just not there. When working primarily in a developing nation and then trying to setup a live remote in a developing nation, you quickly find how the designation 'developing' was determined. Everyday services you would normally take for granted become hard to procure. In one Eastern European country, if you entered a facility with a telephone line that had a dial tone, you were considered lucky. Otherwise it would take three weeks to activate the dial tone on the line. If you were unlucky enough to need an actual telephone line installed, it could take at least one year.

Generally the active agents for an infrastructure that is lacking are three fold; regulatory authorities, service providers and local users. Specific infrastructures we will now examine include electric power, telephone systems, Internet services and satellite access.

Regulatory Authorities

Most countries have regulatory bodies that set and monitor standards for telecommunications systems, frequency management, building and electric codes. These standards, when they exist, usually comply with applicable, well documented international standards. This holds true in all developing nations. In the United States, most European nations, Japan and South Korea for example; the telephone, electric and cell phones systems are world class, stable and reliable. If specific location factors are taken in to consideration (e.g. ISDN interface used or electric power voltage, etc.) almost all professional broadcast equipment will work as specified by the manufacture.

Unfortunately in some developing countries, standards are used more as loose guidelines for building and maintaining a telecommunications system or power grid. Local regulatory authorities, when they exist, focus more on limiting access based on the

maximization of tariffs and fees. Additionally, in countries where poverty and corruption are rampant, well intentioned regulatory authorities are sometimes subverted by dishonest representative agents.

In one country where RFA frequently does live remote broadcast from, the World Bank once reported in regards to bribes that; *“Seventy one percent of large firms report that these payments are frequent. The private sector estimates that unofficial payments cost firms an average of 5.2 percent of total sales revenue.”* The report goes on to say that *“Government employees are much more likely to think that corruption ‘greases the wheel’ and that most businesses pay bribes.”*

Factoring in this reality it is easy to understand how businesses that provide any type of service can be confused as to what level of support they are officially authorized to offer. As a result service providers will tend to concentrate on expanding their customer base rather than then worrying about regulations or the overall quality of service.

Service Providers

It would be unfair to blame the regulatory authorities alone as the service providers also contribute to infrastructure problems. If rules can be overlooked to maximize profits, they will. It is not unusual to find cell phone services oversold and networks busy because of saturation. Electric power comes in at low voltages regularly and loss of service is often experienced due to an overloaded grid.

Approximately five years ago, the largest cell phone provider in one developing nation’s capitol lost access to international phone service. The Ministry of Post and Telecommunication blamed the cell phone provider. They claimed the provider did not follow the technical regulations because of “greed.” The Ministry further accused them of overloading switching equipment. The equipment was set up to allow a maximum of 100 users but as many as 200 users were accessing the system at a time which caused the network to breakdown.

In fairness to the service providers, there can be a great deal of confusion caused by regulatory problems. Many times it is unclear if you just bought and registered the right to provide and distribute a specific level of service or if you just paid a corrupt, lower level inspector to go away.

Local Users

Further compounding these problems in some developing nations there is the common problem of the ‘piggyback-user.’ The piggyback-user is a local who steals a service by simply tapping in. This is not taking advantage of open opportunity, such as turning on electric power at a meter box or connecting into an

open cable port in a junction box as you would rarely find in the USA, piggybacking is actively connecting into another user’s service.

An example of this would be finding that the POTs line that you were expecting to use for field stringer reports is actually an ad hoc party-line. The party you now share the line with is unknown to the local phone service provider. Your new line-mate most likely climbed a telephone pole, spliced into a random telephone-pair and tossed a wire into their house through an open window. This not only applies to telephone service but all services that can be spliced into such as electricity and cable TV.

Zip cord and electric tape seems to be the piggyback-users medium of choice. In some countries you can literally walk down the street and count dozens of these unauthorized taps denoted by their telltale electric tape splice where you can follow the zip cord into an open window.

Electric Power

In some developing countries, the stability and reliability of the electric power is best described as changing. The most important considerations when powering a home or office, or even trying to pull off a live audio feed when dealing with electric power is to both protect yourself (first) and your equipment (second). In some countries an electric ground is either not part of the code or is generally ignored. Grounding is not only essential to help ensure clean audio but also important for your own safety.

Electric Power Solutions

When traveling outside the United States and using standard 120 VAC equipment, it is essential to bring along a reliable AC Line Voltage Regulator; Furman is one company that make many reliable models. This is one piece of equipment you do not want to skip so you can save some money. There are inexpensive voltage converters commonly available, but in our opinion, it is best to purchase one that has earned its marks. They are simple step up and are really just transformers in metal cases.

The Furman AR-PRO 30 Amp Worldwide Line Voltage Regular is a good choice. The unit delivers a clean 120 volts output from input ranges of 88 to 264 volts. The unit protects against line voltage irregularities including voltage sags, brownouts, or over-voltages while handling loads totaling over 20 amperes.

It is not a bad idea to use the AR-PRO or a similar device on all remotes, including domestic events in the United States. AC line filtering and controlled power regulation is never a bad thing. The downside of using

the AR-PRO is that they are heavy; at 50 lbs, they certainly are an extra load to carry around. It is not a travel-friendly piece of gear to be thrown into a suitcase as you rush off to the airport.

If you are using local power standard equipment it is best to purchase an Uninterruptible Power Supply (UPS) locally. A good rule of thumb is to buy the biggest and best UPS you can quickly procure. This will filter the local power and offer additional short-term backup if there is a power failure.

Regardless of whether you are using a Live Voltage Regulator or UPS, use this unit and only this unit, if at all possible under load conditions, as the only power source for all of your equipment. If additional outlets are required, use power strips off the Voltage Line Regulator or UPS. Power strips should have ground-fault circuit interrupter (GFCI) circuit breakers if possible. The GFCI works on the principle that the hot and neutral wires in a single-phase circuit carry the same current when operating properly. If one of these wires carries unequal current than the other wire, then a ground-fault is assumed and the GFCI will trip and break the circuit.

Grounding Issues

As far as grounding goes it is sometimes easy to determine if an electric circuit you are using is grounded. If you are connecting to a receptacle with only two prongs then it is safe to assume there is no ground. Even if you see three prongs, do not assume a ground is present. Check the receptacle with a Volt Ohm Meter (VOM). It is always a good idea to carry a VOM. If you forgot your VOM, they are fairly inexpensive and easy to find worldwide. If you do not know how to test a receptacle for ground with a VOM then you are better off staying away from this test. It is always a good idea not to stick things in an electric outlet if you do not know what you are doing.

If you are certain you do not have a ground then run one. Find some heavy gauge wire and a nearby source for ground which can be some part of the building's main support structure, preferably a cold water pipe. Using a clamp or even a pair of vice grips, securely attach the wire to the ground source. The other end of the wire is then attached to the case of the Line Voltage Regulator or the UPS. Once done it is now even more critical to connect all your equipment to only this grounded power supply source. If you use any other power source for your equipment you run the risk of a ground loop.

A ground loop is a condition where you have two or more ground references in a common system. When two or more grounds have a potential difference between them, then current can flow. This flow of

current can interfere with the normal operation of, or, if the potential is great enough, cause damage to your equipment.

Telephone Systems

A telephone line in some countries is an adaptable concept. In an ideal situation, when ordering a POTs line you can expect a standard telephone line with the minimum frequency response of 300 to 3,400 Hz. This is the parameter that most modems and other telephone interface devices such as hybrids and codec's are designed to work under. Unfortunately this is not always what you get in developing countries where lines with reduced frequency response, excessive noise and ground loops are common.

There is not much you can do to troubleshoot a bad telephone line. Complaints to the Central Office (CO) are generally ignored. Trouble tickets in most situations are only generated for one problem and that is a loss of service. It is a good idea to check all the building demarcation points you can find and tighten them up the best you can. Looking for loose connections and fixing them never hurts. It is generally a good idea, for safety sake, to try to stay off utility poles regardless of how much they look like the need attention.

If you find you or one of your coworkers is traveling overseas, take along good phone line surge protectors. Telephone line surge protectors should be the first device that you should connect to any unknown telephone line.

Phone lines worldwide, are susceptible to spikes, transients, surges, noise and disruptive interference which will also damage equipment. A word to the wise: do not pinch pennies on this. Do not trust the telephone line surge protectors built into power strips either; they may be good for personal use, but if you're relying on the power and the phone lines for professional work, stay with professional gear. A good telephone line surge protector should cost between \$30 and \$50 each. It is a great investment if it keeps your expensive phone coupler from being damaged, and more importantly, it let's you send audio to another location. A good supplier for telephone surge protectors is Electronic Specialists, Inc. in Natick, Massachusetts.

To ensure that you have the best POTs line that is locally available, ask the service provider if it is a 'fax line.' Internationally, a fax line is usually a buzz word that denotes a clean decent telephone line. Fax lines can be expected to perform within the standard telephone frequency response range. As the name suggests, on a fax line a fax machine is guaranteed to work by the service provider. Therefore it is safe to assume most other telephone interface devices will work on a fax line too. If a fax line is available, then assume your

regular phone lines are inferior in some way. The availability of a fax line should be taken as a warning that there may be more trouble with your phone lines in the future.

If a fax line is not available and if the phone line is of particularly poor quality, a little investigating may reveal you are not on a POTs line at all. In the United States, the concept of a 'station' cell phone is alien. In some countries this translates to an antenna on the roof that connects to a black box, usually in a closet, that breaks out one or multiple (depending on the number of SIMs in the box) cell phones to regular dial tone(s). The dial tone is then connected to standard telephone set equipment. If your phone line sounds like a cell phone then there is a very good chance that it really is one.

Cell phone networks also come with their own particular problems. In developing countries networks are almost always oversold and at times it is hard to get reliable connections. In addition, providers not being hampered by regulatory limitations on cell transmission levels sometimes will save their cost on cell tower installations by boosting the network transmission power levels and spreading the cells as geographically far apart as possible. In a cell network, this overpowering can cause distortion, call interruption and can actually radiate noise into the other equipment you are using for your broadcast work.

We have witnessed equipment such as PC audio cards, minidisk recorders and consoles picking up a ring tone buzz every time a cell phone rings within three feet of the equipment. There is also general constant noise interference generated when cell phones from an overpowered network are used in close proximity to the equipment.

In any country you manage to secure an ISDN circuit, chances are good that all the phone services will work great. Generally speaking, it is safe to assume at this point you are not in an infrastructure challenged venue but one with a fairly modern telecommunications system.

Telephone Solutions ISDN

ISDN stands for Integrated Services Digital Network and is a circuit-switched telephone system network which also provides access to packet switched network. On packet switched network we can digitally transmit voice and data using a normal twisted pair of telephone wire but the result is increased quality over a POTs signal. Before ISDN, POTs lines were the main network used to get 'voice' from one point to another. ISDN integrates speech and data on the same communication lines providing greater capability than previously available on POTs lines. ISDN can also be

used for Internet access with a maximum of 128 kbit/s in both upstream and downstream.

When we can have an ISDN line available to provide audio to and from RFA locations, we generally use either the Telos Zephyr or the Nagra Ares C with ISDN interface. The Nagra is used for events where we want to make a safety backup recording of the entire event as it is primarily an audio recording device that uses a PCMCIA card as a storage media. Using the Nagra allows us a secure, worry free recording as the backup recording path is the same as the ISDN transmit path.

Regardless of the ISDN codec device you use, it is important to do your research and make sure the ISDN interface is compatible for the country where you are planning to use the device. If it is not, the manufacturer can usually supply you with the correct interface that can be easily installed in the unit.

Worth a moment of further discussion is whether ISDN lines can be ordered anymore. Just a few years ago we were told by our phone service provider the East coast the ISDN lines could no longer be ordered; in fact, the phone companies were phasing them out. It appears to be the same in other parts of the world. If you have an existing ISDN line, you are fine for the moment but if you want to order new or more ISDN lines, look for some other alternative.

Telephone Solutions POTs

For acceptable quality telephone lines, codec devices are our first preference. Codec's offer far superior audio quality compared to any type of telephone hybrid. We have used the Comrex Hotlines and Blue Boxes in several countries with great success.

When the telephone lines are of particularly poor quality, the Australian made TieLine TLF-200 Patriot always performed well for us, but with the use of Voice over IP (VoIP) through Skype, we have relegated the TieLine to a backup transmission/receive status. Designed for use in the Outback, the TieLine has a very robust modem design capable of connecting at lower data rates and will sometimes work when other codecs can not connect. If the telephone line degrades further when in use, the TieLine will automatically shift the data rate to ensure no loss of audio.

If the telephone line quality is so poor that using any codec is out of the question, we move down to a digital hybrid. Digital hybrids offer enhanced audio quality and better null separation over a telephone line than analog hybrids. Our digital hybrid of preference is the Telos One, standalone version.

If we are producing a more complex program with multiple telephone feeds, we use multiple line call-in show digital hybrids. The units we use will be either

the Telos 2101 or the Gentner TS612. Both units have dual digital hybrids and can bring two callers to the audio console independently. Both units come with nice, intuitive control surfaces too. While they both work great, they also seem to be a little more sensitive to extreme telephone lines. It is from using these units and burning out input cards that we learned to praise the abilities of telephone line surge protectors. The surge protectors are always in line first and now the units work flawlessly.

There are times though due to excessive telephone line noise and interference the digital hybrids, regardless of manufacturer, will not work. It is not so much that they do not work but they suffer from severe sound degradation. The audio quality becomes so bad the telephone earpiece actually sounds better than what you are getting out of the console.

When this occurs, our next step would be to go 'old school' and break out an old analog device. Analog devices tend to be the most dependable when dealing with very low quality telephone lines. Our first choice would be the Comrex LXT/R Single Line Frequency Extender. This device works with on standard telephone lines and in a pinch over a cell phone connection. By using frequency shifting, the LXT/R allows the connection to pass an additional 250 Hz of low frequencies which sound substantially better than a straight telephone connection. It also sounds like it cleans up line noise even though the manufacturer makes no claim to that effect. Unfortunately, frequency extenders tend to be only half duplex and often require a second telephone line for Internal Fold-Back (IFB). When used as a one-way device, the LXT/R is used as the program transmission line.

There are still times when the telephone line is of such poor quality that even an analog frequency extender will not work. In some cases, we have been lucky to have one telephone line available and simply can not lose all communications and go half-duplex with it. When that happens, we dust off our Gentner SPH-1 analog telephone hybrid. While analog hybrids do not eliminate line noise or greatly enhance the audio quality, they do provide a broadcast interface and offer a greater degree of null separation.



Figure 2: JK Audio's THAT-1

In a pinch we have even been known to use simpler analog interface devices such as the THAT-1 by JK Audio. The choice of what method is used to interface with a telephone line is sometimes driven by what tools we have at hand. This is especially true in a geographical location where professional broadcast or electronic stores do not exist. In this situation, you can almost always find a device that connects between the handset and the telephone set. Commonly called a phone tap, or some variation of that, these small plastic devices can be found in the most remote electronic shops worldwide. While this is not considered professional broadcast gear, at least it offers a connection breakout point from the telephone set.

Telephone Solutions Cell

When we are in a situation where it is impossible to secure any telephone line, we often try to make due with a cell phone connection. We think it is safe to say that many will use their cell phones to call in new reports and stories just for the sake of expediency. The danger in using a cell phone lies in the transmission of prerecorded audio. We have heard audio from the field many times that has been simply played back out of a handheld recorder into the mouthpiece of a cell phone. To help reporters provide the best audio quality possible, the interface device we generally use for cell phones is the Flip Jack made by Conex Electro-Systems. The Flip Jack connects to the cell phones headphone/mic jack and yields balanced line or mic inputs and line outputs. When on the spot and no other connection can be found, the Flip Jack can supply a broadcast path, albeit at cell phone quality.



Figure 3: Conex FlipJack

Satellite Phone Options

Satellite phones are an evolving stable technology in the sense it is safe to assume whatever model you buy will be obsolete in under a year. In 1997, RFA purchased its first satellite phone, a Nera Worldphone. This is a bag phone without ISDN capability but it does provide standard phone audio quality from remote, isolated locations where cell phone networks were not available. This phone is still a part of our equipment inventory and waits for the next event to come up where POTs and cell service is limited or non-existent.

Our next generation satellite phones were ISDN capable Thrane & Thrane Mini-M phones. Remote broadcasts and feeds suddenly had high quality audio from any location where phone service is unavailable. We have used ISDN satellite phones extensively from outside venues and other locations where we needed better than telephone line quality. These phones are only used when the need is such that the extra monies spent for the phone calls are worth the price. RFA has two of these and, like the Nera Worldphone, both are still available in our equipment inventory.

With our headquarters in Washington DC, the January 2009 inauguration of President Obama promised to through the city into turmoil with the promise of 1-2 million visitors for the one event. Since it was a new item worth some coverage by our reporters, we knew that we had to have people in the city and knew we may have to work around total saturation of Washington DC's cell phone networks. To ensure our field reporters could make domestic calls back to our main studios, we rented 9 Iridium 9505A pre-paid phones from Outfitter Satellite Phones in Tennessee.

Here are the specifications for the 9505A:

- Size: 6.2x2.4x2.2 inches
- Weight: 13.2 oz (375 g)
- 3.6 hours continuous talk time
- 38 hrs continuous standby time
- Power: 0.645 W (average)
- Display: 4x16 characters



Figure 4: Iridium 9505A

As simple to use as a cell phone, we sent our reporters out with these as backup audio links so each reporter would never lose communications with our main studios in the city. The quality of the calls over the Iridium system was as good a standard cell phone call. In the long run they were a great insurance policy against the threat of cell service saturation.

For all the bag type satellite phones mentioned previously, ISDN or not, there is a separate antenna about the size of a laptop that needs to be precisely aimed towards the correct satellite. It is critical to know the locations of all available satellites and not assume

the expected closest one will work. In many instances the satellite we thought was the furthest turned out to provide the best connection. We also learned the hard way that a site survey was the best method of ensuring we had a clear view of the satellite when it came time to transmit audio. Based on the service information we had, we assumed we would have our choice between two satellites. In June 2008 we delivered satellite phones to Phnom Penh, Cambodia and when we initially tested them, the one satellite we could use was the Indian Ocean Regional (IOR) satellite. The other, the Pacific Ocean Regional (POR) satellite was evidently too far over the horizon for our purposes. In the scorching heat and humidity of the Cambodian summer, we took a chance and carried all the gear to the rooftop of one of our FM affiliate stations and luckily found the Southwestern sky clearly available to us. After setting up the Thrane & Thrane 3080A, we consistently received a 'no network available' warning on the Nagra ARES-C we married up with the TT3080A. Remember what we wrote earlier about Murphy's Law and that what can go wrong will? The cause was traced to a bad Ethernet cable used to connect both units to each other. Even a replacement cable fashioned quickly by our affiliate's staff was unable to make the proper connection. Our local technician returned to RFA's office to pick up a commercially produced cable while another technician stayed on the roof of the FM affiliate to keep watch on our gear. When the local technician returned with a new Ethernet cable, all the pieces fell into place! Communications between both units was confirmed and further operability of the system was confirmed when the on-duty staff at RFA's Master Control in Washington DC confirmed that they were receiving a quality audio feed from our perch on the rooftop. As part of the delivery and training assignment, we powered off and then dismantled the entire system. It was time for another test, but this time the local technician did all the work; and did it flawlessly. With another confirmation from RFA's Master Control that the audio was received perfectly, we broke-down the entire setup one final time before we thanks our hosts and returned to RFA's Phnom Penh office.

Other Satellite Phones

After running through several generations of handheld satellite phones we are also using ACeS (the Asia Cellular Satellite System) phones in our Bangkok and Phnom Penh offices. These are dual mode satellite and GSM capable units and are the smallest handheld phone of its type. The phone will automatically switch to either the satellite or GSM network depending on availability.

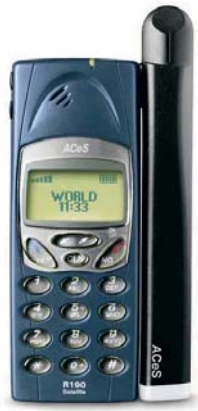


Figure 5: ACeS R190

The ACeS network footprint is exclusively in the Asia Pacific region. The last time we checked international calls by satellite cost in the range of approximately \$1 per minute. GSM calls are charged at the conventional roaming rate. While the Southeast Asian footprint is acceptable for RFA, it may not be a good satellite network for your needs. The actual satellite/GSM phone is an Ericsson R190 pocket phone. With a little research, we are confident that you will discover a network in the area where you need it.

Internet Options

We normally find Internet access in developing countries some years behind the United States as far as development and availability. In some cases, it is non-operational or even nonexistent. Reporters that live in provinces no place near an RFA facility must rely on any existing Internet connection, or simply rely on POTs or cell phone service when providing news reports. We consider ourselves extremely lucky when we find we have a venue with Internet access. Oddly enough, having Internet access seems to be independent of the type of telephone service available. In most developing countries, telephone service providers and Internet Service Providers (ISP) are entirely separate operations. It is our theory the telephone service providers are making money off the Internet whether they actually provide service or not so why go to all the bother of actually providing Internet services?

Dialup Internet Access

When dialup access is available, the phone company charges per minute for the connection and you pay by the minute for access to the ISP. Again, we assume that both the telephone company and the Internet service provider make their 'cut' off this arrangement. Generally you pay the ISP by purchasing time in advance usually in the form of a prepaid card. You must carefully monitor your ISP use. When your prepaid time is out you are bumped off the Internet and denied future access, until you buy another card that is.

If you are extremely lucky, you can secure a broadband Internet connection. This is surprisingly becoming more and more common as most all broadband in developing countries is being provided by wireless delivery methods. In one venue where we were working from a hotel room, the entire 300 room hotel only had seven outside telephone lines but, they did have broadband Internet access.

When dialup Internet is the only thing available, we use it in live events. AOL Instant Messaging (AIM) has traditionally been used to replace secondary open telephone lines for engineering purposes. Only in the past year have we moved away from AIM and have moved towards the use of Skype and its 'chat' function for engineering communications. This also works perfectly well for a reporter who needs to notify us of some pending phone feed or the transmission of audio via FTP, email, or by some other method.

For remote features and reports that are not live, we use the Internet for FTP program transfer. Admittedly from all that you have been reading at times, our overall program quality on shortwave radio, especially when transmitted over a noisy international telephone or cell phone connection, can be best described as wanting. This is a tradeoff we make for the excitement of live broadcasts of events from a venue no other broadcaster has access to. That said, for a repeat broadcast, Internet streaming and general reuse of the live program, a locally recorded safety copy is made for all live events. This safety copy is FTP-ed to our main studios in Washington DC immediately after the live broadcast is complete. Should the recording made in Washington DC during the broadcast fail, we still have a high quality copy of the program available.



Figure 6: FileZilla

For an FTP-client, RFA uses FileZilla. FileZilla is open source software distributed free of charge under the terms of the GNU General Public License. It is a powerful FTP-client that is available for Windows, Mac and Linux operating systems. Most important for our reports around the globe is that FileZilla lets you resume uploads in the event of line interruptions (as when a prepaid card runs out). FileZilla is also secure and can make SSL connections and offers GSS authentication and encryption using Kerberos. Prior to FileZilla, RFA used FTPVoyager. While FTPVoyager is a fine product, it cost us money to buy a site license. Since we must live within our budgetary constraints, when FileZilla became available, we were quick to transition to FileZilla.

Before sending a reporter out to send their feeds by FTP, we must address three things critical to this process: training, hardware and software

Training

Preparation and training are the keys to the success of the reporter going out into the field with plans of recording, editing and using FTP to send their feeds. Training guides written specifically for your organization can be very helpful as many people are overwhelmed by manuals with hundreds of pages. These guides should be saved as PDF on to a flash drive, CDR, or other media or even onto their laptop so they are conveniently available when needed. Training should also focus on common ground between the audio editor and the programs already familiar to the user, for example, CUT and PASTE, are the same functions whether used in an audio editor or Microsoft Word. Training on the use of FTP is usually very straightforward, as most FTP clients support the saving of frequently visited SITES, presets that default to both the target FTP site and the desired local directory on their computer.

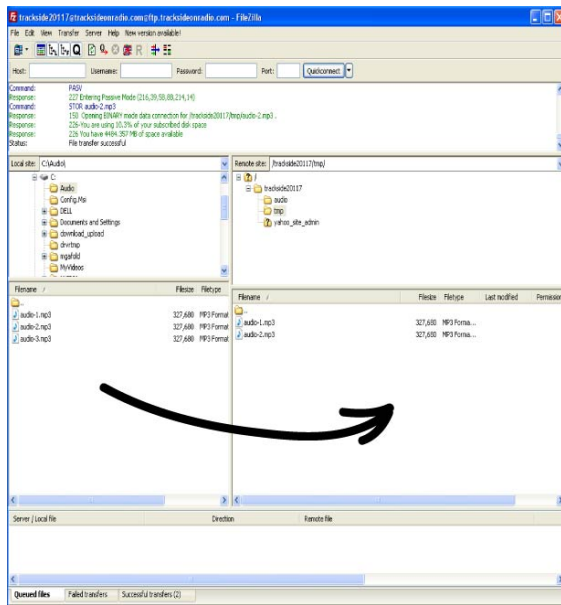


Figure 6: After setup, FTP is as simple as drag-and-drop

Hardware

The laptop computer is usually the central piece of hardware for this process. It acts as a DAW (Digital Audio Workstation) and runs the FTP client software. The audio can be recorded using the audio inputs of the laptop, edited on the laptop and then sent via FTP. Improvements in the S/N ratio of onboard sound cards make it possible to record broadcast quality audio in this manner. If using a flash memory based recorder with USB, the audio can be copied over to the computer much faster than real time. Other options for recording

the audio include USB headset microphones and dedicated USB microphones. These improve the S/N ratio even further by bypassing the onboard soundcard.

Software

Beside the FTP client, the remote computer needs an audio editing/recording program. We use Audacity, an open source editor that is highly flexible. There are many other open source and commercial audio programs available as well.

Cleaning up feeds (Plug-ins)

Despite our best efforts, sometimes a feed has undesirable noise. There are steps we can take to improve it. Most, if not all, audio editors include or support plug-ins that can be used to improve the sound. These include various types of EQ as well as Noise Reduction, in which a sample of background noise is analyzed and used to subtract that audio profile from the source audio.

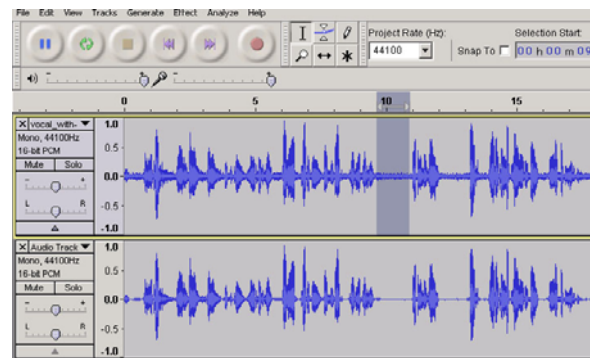


Figure 7: Top Track- noise is selected
Bottom Track- after Noise Reduction plug-in is applied

Audacity supports plug-ins written by the end user in the Nyquist programming language. Detailed information about using Nyquist with Audacity is available at audacity.sourceforge.net/help/nyquist.

```
RFA Telephone Clean-up.ny - Notepad
File Edit Format View Help
;nyquist plug-in
;version 1
;type process
;name "1- RFA Telephone Clean-up ..."
;action "Performing Clean-up..."

(highpass8
(lowpass8

s

3000)
300)
```

Figure 8: A few simple lines are enough to write an EQ preset plug-in in Nyquist

This has given us the ability to write some plug-ins tailored to our users such as the “RFA Telephone Clean-up”, an EQ based plug-in. This plug-in uses 8-pole low-pass and high-pass filters to drastically cut frequencies below 300Hz and above 3 kHz. These frequencies are not carried by POTS lines and when they are present, it is usually in the form of line noise and distortion. When these frequencies are eliminated, it often results in a much cleaner sounding telephone recording. The benefit of programming this into a plug-in is simple: it is much easier to train someone to try this plug-in on a noisy phone recording than to teach them the audio theory behind it and how apply the EQ.

Live Broadcast Using the Internet

If we can manage to secure stable Internet speeds of 35k or better and do not have access to an ISDN circuit, we will usually use a Voice over IP (VoIP) program called Skype as our program transmission line. We cannot say enough about this powerful communications program.

Due to budgetary constraints at RFA, Skype lets us provide additional, and extended, live programming when it otherwise would not have been affordable. With a satellite ISDN feed costing up to six dollars a minute and an international telephone call sometimes costing up to four dollars per minute, you can see where 100 extra minutes of programming can add up very quickly. Skype lets us to establish a phone quality connection using the Internet. The added benefits of chat, and video calls makes Skype a very powerful broadcast tool for RFA.



Figure 9: Skype

Skype has been on our list of regular broadcast tools for over 5 years. It is installed in all our on-air studio’s and is used regularly between RFA’s staff no matter where they are in the world. While we do experience occasional buffer and connectivity errors, Skype has been highly reliable, and most times sounds better than a standard telephone call. Skype calls are secure with end-to-end encryption. Firewalls and routers present few issues, if any, so there is usually no special configuration needed. Skype needs unrestricted outgoing TCP (transmission control protocol) access to all destination ports above 1024. Voice quality and some other aspects of Skype are greatly improved by opening up outgoing UDP traffic to all ports above 1024, and allowing UDP replies to come back in.

Skype was created by the same people who created KaZaA. Like KaZaA, Skype also functions on a peer-to-peer connection unlike other Internet VoIP programs which connect though a central server. Skype also established multiple connections paths over the Internet and will automatically switch to the most dependable path with the least latency.

More audio over IP

In addition to Skype, dedicated hardware-based audio over IP solutions are being used in most of our bureaus to stream audio to DC. Besides being more cost effective than ISDN, they are working in places such Phnom Penh, Cambodia, where ISDN is not available. ISDN circuits are becoming more difficult to obtain and maintain, and in the future, as that technology phases out, will not be an option for broadcast facilities.

EQUIPMENT REGULARY USED

In addition to equipment that has been mentioned previously, the following is a short list of equipment and software we routinely travel with:

- Samson Tech’s Zoom H2 Handy Recorder has recently replaced most of the mini disc recorders throughout RFA. In 1996, we primarily relied on the Marantz PMD221 cassette recorder use in the field, which was replaced by Sony’s MZB-300 mini disc recorder. As mini discs fade from the market, it was natural for us to move on to a flash recorder; the H2 was our choice of the many brands available.



Figure 10: Zoom H2

- The Shure SM-58 unidirectional (cardioid) dynamic microphone. Rugged construction with a shock mount system that stands up to rough handling. This has been a mainstay of field recording for RFA for over a decade.
- The Shure FP-33 portable stereo mixer specifically designed for remote audio recording.
- The Yamaha 01V Digital Mixing Console. 24 input channels, including 16 built-in analog inputs and capable of programming 100 presets into memory.
- BSI's WaveCart software that is the digital replacement for the cart machines with fast WAV file playback.
- Audacity digital audio recording and editing software. An outstanding audio tool that provides excellent results for no cost.



Figure 11: Audacity

This list is by no means all inclusive. The nature of supplying a reporter or a stringer with equipment, or even a traveling audio technician, includes the all too familiar “this is all I need, all this stuff and... this Comrex Mix Minus Bridge and... this Sampson Audio Adapter kit and... these microphone stands and... these AKG Headphone Mics and...” We like to call this the “last minute, still room in the suitcase/anvil case so throw it in” syndrome. When you get in this mode, viewing one inch of open space tends to transform equipment and other miscellaneous accessories into

packing material in our minds. Why use bubble wrap when a few extra headphones fill that empty space nicely?

One last note about signing over gear to someone who must travel: travel with your critical equipment as carry-on if you can and never lose sight of it. A Shure FP-33 Mixer, a Telos One (without the power supply), a couple of mics and a laptop will fit easily in a carry-on bag. This will guarantee that you have the enough equipment on you when you arrive at your next location.

CONCLUSION

Not all of your venues will be ones that require you to travel for days to an isolated region of the world like RFA but perhaps all professional broadcast engineers should approach all events as if they were. Regardless of where your next live event will be, or where your reporters live, we think it is safe to assume there is no such thing as:

- Being Too Prepared
- Packing Too Much
- Doing Too Much Planning
- It's broke so don't fix it

You or someone else will always be short of some piece of equipment you should have remembered. The unexpected will happen even at the best of venues. Being close to home in the United States sometimes spoils us with having access to stores that stock and sell professional equipment and spare parts. Additionally, the close proximity to your home base and access to overnight delivery services that are really overnight (not four days) is a blessing that can not be overlooked.

Experience is a great teacher but one must learn that experience should not translate to inflexibility. Some times an untutored idea like “why don't you just tape the cup from your headphones to the mouthpiece” may just save your broadcast.

Never be afraid to try to fix any piece of equipment in the field. What is the worst that can happen? Do you think you can break it worse?

The bottom line is to get your audio on the air or to the studio so it can make it on the air; try anything and everything. Ask the receiving end if the quality is acceptable and don't tell them what you had to do to get it to them until you get home.

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