

Transcription Q&A Session Simulcast Forum VI March 13, 2003, Las Vegas, NV

Joining Joe Blaschka and Lou Albert is Steve Dubberstein of Communication Service. Steve was a Motorola employee for 17 years. From '89 thru 2000 he was based on Hong Kong and Singapore and was Motorola's Director of Engineering for the Asia Pacific Cellular Infrastructure Group. In 1995 he was responsible for the design and start-up of the world's first commercial CDMA cellular telephone system. In 2001, Steve became a company engineer at Communication Service, an MSS with shops in Madison, Portage, and LaCrosse, Wisconsin. Steve has his Bachelors of Electrical Engineering from the University of Wisconsin.

We have three successful simulcast integrators, each with varied experiences. You may ask questions of the group, or individually.

Q: One of the important things in simulcast planning is rf coverage prediction. What rf coverage systems do you use, and what are its the pros and cons?

Lou: The system we currently use is MA/Com Wireless's Raptor system. At present I think it's available to consultants and engineers. I think they would want you to go to Lynchburg to learn to use the software. We did go down to a class to learn to use the software.

Pros: It really does everything you want it to do. It is really tailored to their base stations, so there are references to their station's high and low power, but there's all the antenna patterns you could possibly want. It does TDI analysis, which is a plus to us, we don't have to figure anything out. I do not know the current status of how the software is available, and how long it will stay available to those not internal to MA/Com.

Cons: I have seen demos of other people's programs, but have not gotten the software.

Joe: I have these glasses that allow me to see rf, so that's how I do it. Actually, if I did, I wouldn't be sitting here, I'd be on a beach somewhere in Tahiti. We use RadioSoft software. We used to use TAP software a long time ago, and found that the user interface was difficult, and RadioSoft had better user interface. RadioSoft does have simulcast capability. You can crank in your timing value and then it will show you areas that exceed the 83 microseconds or 70 microseconds or whatever you're going to put into it. We have found that RadioSoft works pretty well, and we have been pretty happy with it.

Steve: First of all, I'd like to apologize for my voice. Maybe it will give you an idea what simulcast sounds like when it's out of phase. (laughter) We also use RadioSoft, but from a lot of experience previous to two-way with propagation prediction software, you have to use a little care. Propagation prediction software uses a lot of colored plots and stuff, will give you a color for a certain signal

strength, and sometimes will give you a false illusion as to where something is strong and where something is not. Some of the issues we've had with simulcast is where you think simulcast should be being received from one site even by the prediction software but in reality it is stronger from a different site, and so the phase difference is much bigger than you'd expect because it's outside of the overlap area but not being received by the site you expect. I think you have to treat that with care and the best thing is to know your own system. If you are working for one of your own customers and you know your own system, take that into consideration when you use that.

Joe: I'd like to reiterate that statement. But, when you do use coverage software, lot of rf can exist at where you don't expect the coverage to be, not just where you want it to be, because that's where you get into trouble. You'll look at 1 to 250,000 or 1 to 100,000, and you say, "Oh, it covers great here, you zoom way out, and make sure you're not getting coverage 35 miles away, where you've got a line-of-site shot", and then you're going to have a huge phasing problem there.

Q: Discuss the knee of compression and how to make sure that the person listening to the radio can actually hear what they're supposed to hear.

Joe: We sell all the cops those little ear things so they can hear what's going on. (laughter). So if you're a dealer, it's great, you get to sell some more stuff. Those things are expensive, and they break them, so they have to replace them all the time. So it's kind of like selling toilet paper. That is a problem, and I don't know if there is a good solution for it. One solution is to go back to all your non-simulcast channels and make them the same. The biggest complaint that we get is that usually they are listening to the simplex base station that's deviating 5-1/2, 6 kHz because nobody is paying any attention to it, or the tech kept making it sound better, and then they listen to the simulcast system which is set the way it's supposed to be set, all legal and all, and it's at 3kHz, and so the problem is really the difference, and they have to keep changing their volume control back and forth. So you make sure channel deviations are all set the same. We've had to do that with a couple of systems, find out which channels they are listening to most often, and make sure they are set the same - that helps. Narrowband can be more of a problem, because you're dealing with narrower deviation. Theoretically the audio processing has a little more gain to make up for that, but I think we're going to see just in general when they shift to narrowband we're going to hear more complaints about that problem.

Q: Relative to a single site operation, describe the tower configuration that should be considered when you go to simulcast.

Lou: I haven't had any experience using shorter sites. I guess if your system is new, you have the option to select your sites. I don't have actual experience using lower sites versus a huge 3-4000 foot mountain. Lower would be better for the system overall. But the problem is, most systems are already located, and people

are just converting whatever they have with a tower already located on top of a hill. My experience has been with higher sites already in place.

Joe: I agree with Lou. Too many times you have to live with what's already there. They've already got the investment in the microwave, and the sites, and all that, so you have to deal with it. Sometimes you can deal with it with antenna patterning and stuff like that if you run into too much of a problem. In general, if we start from a clean slate, we try to pick lower sites and use terrain blocking to our advantage. That will reduce the overlap areas. And the more you can reduce the overlap areas, the better your system will sound and the easier it will be to maintain. If you start from a clean slate, even if it's a high site on the top of a ridge, position your antenna so it is not looking over the side of the ridge, only on the side of the ridge you want to look at.

Steve: I'd say many times you are stuck with the sites you have. Over the years, I've found one of the rules you want to go by is, if somebody already has coverage, be careful if you take it away. When we sell simulcast systems, it's mostly for VHF Quick Call paging which simulcast is quite good at. Every fire fighter and EMT knows all the places where his pager works. If you even lower an antenna on an existing tower, it will quit working in places, and you'll hear about it right away. So take that as an expectation if you're going to, say, if you are doing selective tower paging, and then you go to simulcast, and you want to start change the antennas, you can actually make some people's situation worse where they're not in an overlap area, say they're fairly close to the tower, their pager is indoors, and you lower it, and they don't get any additional advantage from another site, and suddenly their pager quits working. Then they remind the county of how much money they paid you for that, and now the pager works worse, then they call their county board member, and there you go. This is the voice of experience. Again, we do this mostly for Quick Call paging, and the goal for Quick Call paging, is get the signal everywhere. We're using existing antennas, and transmit maybe 100 watts, and we're even scared to turn down the power. We'd rather set the timing and everything else the best we can to make sure the page is still understandable before we reduce coverage. You have to consider the indoor coverage as well as the outdoor coverage, because you just want the guy's pager to go off.

Joe: It's the old story – if it doesn't work in the Chief's office, it's no good.

Ed: The Chief's office and the Chief's home are two important design criteria. (audience – “and the golf course” - laughter). Every once in a while someone will change from a high band system, with, for example, five remote sites, to a two- or three-site 800 MHz simulcast system with no additional remote receiver sites. Does everyone see the problem? Remember that whatever system you change to should have equal or more receive sites otherwise no matter how good the talk-out is, they won't be happy.

Lou: I have an offer for the guys from Boston. We'll be doing the Boston Marathon with a two-site system. One of our sites will be on the Prudential Center and one will be in Wellesley. All the broadcast production on the four channels will be two-site simulcast on a temporary set-up, and you guys are welcome to come down and take a look at it. The Greece Summer Games will probably be simulcasted also, to be determined when I get to Greece.

Q: **Shifting from omni antennas to panel or other directional antennas, what has the experience been?**

Lou: The system we did in Lackawanna actually has directional antennas on one of the sites, only because of a co-channel problem somewhere else. Quite honestly, we didn't see a difference. The only difference that was seen was when two or three sites were on the edge, but that actually was somebody else's problem, because that's not in our county. We've jockeyed stuff around, lowered power and changed things, and most people I've talked to, or when I've called down to Lynchburg, or even some Motorola engineer guys, they tell me they really don't see a problem. I'm not sure anything actually happens. I've never actually experienced anything really changing.

We never got into really doing tests, the one system we did, we were forced to do it. It was there already, and we had to live with what it was. We did try an omni antenna, and noticed no difference in the overlap audio, and just being able to hear it, we never noticed any difference.

Joe: Well, you have to remember that the overlap coverage area the difference in rf you need is 10 to 15 db. You have to look at the antenna and the band. If you're doing it at 800 MHz, you can get 15- 20 - 25 db of front to back ratio, and it might be helpful, the reality is that simulcast is relatively easy to do at 800 MHz because there is already so much multi-path that some of the artifacts of simulcast get blended with the regular stuff that goes on with 800 MHz. At VHF and UHF it's sometimes hard to get those kind of changes. We use a lot of down-tilt on antennas at VHF and UHF, primarily to keep the rf away from the horizon, especially in a county-wide system, so we reduce the rf that's out there 60 or 70 miles. We did a four county system in Idaho. About 85 miles away there was a canyon that we thought was going to get coverage from the local site. Turns out we had horrible audio quality. To resolve it we had to put in a stand-alone repeater to cover that one canyon. Luckily, it wasn't used very much. What happened was there was a straight line-of-site shot down that canyon from a site that was 85 miles away. There's no way to control the audio on that one and that one was kind of a surprise. So, we had to put the stand-alone repeater on that one.

Steve: I guess you'd have to evaluate whether it helps your capture ratio, but again, you have to be careful what you're sacrificing. That's probably the Chief's nephew's pager in that area, you just sacrificed. One of the reasons I agreed to be on this panel, both speakers today started out by saying "Everyone understands simulcast doesn't sound perfect everywhere." I think the number one thing you can do with

simulcast is make sure everybody understands that before you put in the system. That includes meeting with the end customers, so if you're selling a system to fire or EMS, go to your Chief's meeting, or whatever equivalent they have there. We tell them that there are advantages to this system, but there are some trade-offs. The advantage is that when you can transmit on five sites at the same time, you're all going to hear everybody else's pages. There's other advantages that we in this room would understand that you don't usually think of in simulcast, and that is if you have multiple sites that are, say, entering a building, because people are using a typical or Minitor or Quick Call pager, it's usually on his belt, and he's usually indoors, which is about the worst case you can have for receive. If you can enter a structure with a signal from multiple directions, your statistical odds of kicking that pager are much higher. Although you wouldn't think so, if you would page off a single site versus paging off multiple sites, the statistical odds go up greatly than the combination of the single pages in sort of a way because you're at that individual location with fades and everything else that may be going on. You know he may be at the back of the house, the front of the house, the back of the building, Can you start out by explaining that. And then you have to say, the thing is, you can't get it adjusted perfect everywhere, and sometimes it sounds a little bit raspy, but you should always be able to understand the page. If you can't understand the voice, then we've got a problem. But if it's a little raspy, and if you've got a cold all the time, like me, you could do a live demo. (laughter) You can sorta imitate the sound if you've heard it before, especially in the high end. Get that expectation set in their mind up front, so when they hear that later, they'll know what's coming. We haven't done this yet on Sheriff's channels or police channels, but those guys have to listen to the radio 8 hours a day, so you have to make them understand that sometimes it is going to be a little raspy. If you do that up front, your customer satisfaction will be higher in the end and much more realistic, because you'll never get rid of it everywhere. I think in all the presentations I've seen today and at the Forum last year, people are saying this more and more, to get the expectations set. It's well worth doing, but why doesn't commercial broadcast do it all the time? I think we can see that. That's why we can't drive all across the country and listen to 104.1. There's a reason, and we know the reason. But if you get that expectation set, you'll end up with happy customers.

Ed: As a public service, about two weeks before the Forum, Lou Albert sent me some wav files of what the simulcast system sounded like in the overlap when it sounded good, and what it sounded like when it didn't sound so good. Those waves will be available from the Simulcast Solutions website in the next few weeks for you to download. I would encourage any of you that have the chance to create wav files to send me copies to post and help each other out. Again, in the spirit of setting customer's expectations, the best way to do it is to say, "Here's a communication, single site, here's one in simulcast, and what it sounds like in most of the places. In a few places, here's what it is going to sound like. And if this is what it's going to be in a few places and you can't accept that, let's cut the discussion off now, because it's not going to ever sound always like this." I would

like to personally thank Lou for providing the waves. They will be available for you to download in the next few weeks.

Q: In very wide area systems, how do you use a single or keyless monitor receiver and net them together.

Joe: The NSA has these really cool airplanes that fly around with these receivers in them, and that's how you do it. (laughter) They've got a whole bunch of them, the trouble is, they're all in another part of the world. They're all in Iraq. You can backhaul audio without any problem, we've done that lots of times. It's ok if you're doing regular audio. It's more of a problem if you're doing paging because you have to look at the discriminator output because the audio processing messes up the square waves. It is pretty common to put a monitor receiver out there, but remember, the only place you're really concerned about ... if you had ten transmitters going down a road for 500 miles, you don't really care about the one that's 500 miles away at this end and this end, because that's really not simulcast any more. Each one that's overlaps with another is what you have to worry about.

Q: For wide area paging systems, is there any magic to do the alignment.

Joe: My experience with that has been it is a function of the modulation type and rate. You are POCSAG 1200? For delay equalization you use the simulcast delay card in each station? Are you sure that's enough delay for your wide area? My gut reaction is if you are able to get all of your transmitters to fire simultaneously unless you have some huge coverage and overlap issues the first thing I'd do is make sure you've got enough delay in there and they're really all firing simultaneously. That may solve a big portion of your problem. Another thing you can do, is even though the propagation software has some issues, sometimes you can just manually sit down and look at what your timing issues are and what sites you need to consider but probably the best you can do is have them all launch at the same time and see where you're at. It's going to be pretty hard to remote monitor those. The satellite guys do it with hundreds of transmitters over a big area, and they just basically launch all at the same time because they are getting their paging signal from the satellites.

You could regionalize the paging and it will only key a certain block of transmitters, but we've had some issue with that, because what happens is even when you program the pagers to ignore duplicate pages, that works when you're in a good coverage area, but when you're in a poor coverage area, or an area that is covered by multiple zones, you get five pages, because every time you get an error, the pager says it's not a duplicate page. If you've got a state-wide system, my initial guess is that 6000 microseconds is not enough time to ensure that your sites are all launching at the same time. You might have to go out to 13000, 14000 microseconds. You might have to build in some additional delay, you know, fixed delay, to get the rest of it to work ok.

The Tait Quasi-Sync system will automatically adjust timing, for example, and some of the others will adjust timing automatically, or they'll use a monitor receiver and do those corrections automatically instead of you having to do it the "Armstrong" method. But ultimately, that still doesn't figure out where your overlap areas are. That will figure out where your timing is to each area. But sometimes in paging if you have an overlap area, the solution might be to put another paging transmitter in there to reduce the size of the overlap area. Keying them all at the same time would be the first big start.

Q: Anything else about narrowband vs. wide band?

Joe: Not really. I think it's relatively new to the manufacturers. There are differences in the various narrowband equipment, so I think we're still on the learning curve for that.

Ed: John Durham, whose email address and phone number you have on the agenda sheet, did a narrow band UHF system in Botetourt County, and he talked about it here last year. He would be able to address what he learned about narrowband UHF. Once again John Durham is one of the names on the agenda page.

In closing this Q & A session, I would like to ask Steve for his one word recommendation on using analog microwave and analog mux on simulcast.

Steve: I think "DON'T" is a bit too drastic. We've had some experience working with simulcast on some very old Motorola StarPoint microwave to the point where the stuff is really starting to deteriorate. In fact it had trouble keeping a couple of individual channels audio phase locked, which is death in simulcast, and of course it doesn't matter in any other channel if the phase audio is locked, when you're just voting receivers or going out to a transmitter in non-simulcast mode. But we set up a whole system, then the levels would start to change slowly on the card because nobody had touched the system for ten or fifteen years, and suddenly we're pulling cards in and out of the slots, connections aren't as good as they used to be, but DON'T is probably a little bit drastic for analog microwave. You have to analyze your system. You can use audio analog microwave to analyze the quality of your system and how new it is, and I think there's others more experienced than me in that area. But in the future, what we're doing is recommending digital microwave to our customers and then just taking it from there.

Ed: Thanks Lou, Joe and Steve.