ED Today's panel includes Joe Blaschka, Steve Dubberstein, Roger Keifer, and Lou Albert of RF Design and Integration

Q: How did Steve learn the Radiosoft Comstudy software he implemented?

STEVE: Its great software and a great price, but the documentation not too good. We have recently gotten two more contracts for simulcast systems. One is 6 sites and the other is 7 sites. As I was going through the specs, I decided to plot these systems out because the spec called out parameters like maximum microsecond delay. I just played with it for about 3-4 hours until figured it out. That's what I did and I thought what I would do here is put the info on those slides in enough form so you guys could go back and use it. It's great software but not a lot of documentation..

JOE The other thing is you have to be real careful which model you choose. You have Longley-Rice and several other models. All those models are a fictional illusion of whatever the computer thinks the coverage is going to be. Some of them run faster, so sometimes we'll pick a model because we'll want a quick idea of what the coverage is going to be. Some of them work better in VHF than UHF and 800. Be sure you understand what the different models do and their strengths and weaknesses. The choice of a model can make a big difference in your predicted coverage. We have a tendency to use Longley-Rice as the final word, but if you get six sites and a lot of area, sometimes Longley-Rice can take a long time to run, even on a fairly powerful computer. So that's the other key, you've got to make sure you use he right model, but it is a very powerful tool. We've used it for years since the early days and one of things I really like about it is you can plot signal strength with all these different colors so you then you can in one plot see where the signal levels are going to be hot and where they're not, and get a better feel for it. But you've got to invest the time playing with it.

Q: I understand Lou did some interesting experimentation with MTR PL encoding and how the MTR was responding. Lou?

LOU: We were spec'd out by a customer to provide underground coverage for a transit system and one of the specs were to use existing MTR 2000s. What we discovered on the MTR 2000s was, as you peak on wire line audio level, the aux transmit input line you're using for your CTSS was getting compressed. We actually took an MTR on the bench, set it up on

a monitor, and programmed the HP8920 B filter just to see everything below 300 hertz and confirmed this issue. The wire line circuit in the MTR has range from –10 to +5. As you approach 0; the external PL input was getting compressed to the point down to .1 KHz of deviation. Right now the customer is trying to figure out what they're going to do with these 30 stations. We have tried limiting the wire line. The same exact thing happens in different areas of frequency response so the problem is not linear. There's was a lot of experimentation we've done on this and it's not working out too well. We looked back on archives of Simulcast Forum session in which the first phase of this project was performed. Junie Gillen mentions in that simulcast forum that Motorola does not recommend use of MTRs for Simulcast. Be wary. MTRs are used on many of these systems currently and are successful. We do not think they've approached the issue where some people are using XTS portables where there have been some firmware issues and some of the PL decoding where the HT 1000 worked fine and other radios wouldn't. What they're discovering is they haven't had a dispatcher raise their voice level in a transit environment where there's a rail traffic going on and everything's very loud. The way this problem was discovered was transit workers were walking across track or they were going down a platform and basically they're hearing the audio just go away. Basically what it was the PL getting dropped from a .5 down to almost nothing. You can watch this take place on a scope, it was very visible so you want to be aware of that. I think a lot of people are using MTR and just not aware of it as of yet. It might be something that crops up as your picking up audio. We've tried all kinds of compression limiting, start off with a compression limiter on there. Motorola's response to this issue is that this was the way MTRs were engineered and the equipment is not certified for simulcast functions. There is a workaround they are trying to do but it's going to involve actually cutting traces inside the exciter system to actually put external PL in where the PL is injected when you use it as a standalone.

Q What did Roger use for his link transmitters and receivers in the Elk County system.

ROGER CDM750s. They worked out great. It's fantastic link radio.

Q Was it up all the time transmitting?

ROGER The answer is no. We actually hooked a COR output from the CDM750 directly into the PTT of the MTR 2000.

Q Please tell us about your antenna techniques - what you selected / why.

STEVE I think one of the techniques you could do is mount your receive antenna on the top of that tower and side mount your transmit antenna. We have VHF systems, and with VHF systems you get a lot of shading with the antenna on the side of the tower. You can model that in the Comstudy software. You can actually go in and put in a plot and make a plot of what coverage would look like. Then put it right in and calculate time delay and try to figure the whole thing out. But you've got to be a little careful because at least in my opinion one of the reasons for doing simulcast is to have an overall higher signal strength. So if you try to fix something by putting a directional antenna on the other side of the tower it defeats the purpose because you start knocking signal down everywhere which defeats why you did simulcast in the first place. There's a balance in there. In the next system we're going to be putting antennas on the back sides of some towers and things like that.

LOU A lot of times we are only using certain antennas and power limiting for co-channel existence. We'll use some antenna patterns to deal with some offsets and overlap. We are using MA-COM's RAPTR software. Most counties don't give you the choices of sites you want.

JOE At 800 MHz you have many choices regarding antennas with the situation being somewhat the same at UHF. At VHF there are not many choices. A big thing is the use of downtilt. So we use a lot of omni antennas with downtilt still. In the old days you wanted 1500 watts ERP in the horizon. Well, in the new days you don't want high signal levels at long distances from the sites, but you might want a lot of RF around your transmitter site for paging. You don't want that RF out 25, 30, 40 miles because that's where your other simulcast sites are. So, we use a lot of downtilt. The problem is that at 800 MHz and UHF frequencies you can get antennas with reasonable down tilt and in VHF you can't. If you look at how the patterns are it really doesn't buy you anything other to put a 6 dB gain antenna in with 3 degrees of down tilt. It's virtually useless for limiting signal levels at the horizon. It used to be Scala had a VHF omni that had 14 degrees of down tilt. A lot of down tilt and it worked really well for simulcast because you put all your RF right around your site and not at the horizon. That's been a real issue, we tend to beat up the antenna guys now that there's only 3 guys left that build antennas, basic antennas. All of your choices have gone away, you can choose omni or you can choose omni. It may be a cardiod pattern but the basically the same thing, you just really don't get enough pattern differentiation. So that's the main issue we try to use as much downtilt generally at the site when we can, unless it's a low site. If we have to do a low site right into town we will use

a high gain antenna with little downtilt. So the real problem, in general, is trying to keep the RF away from the horizon.

ROGER My only experience with simulcast is with Elk County. The system in our county is relatively small compared to the amount of towers we have there. With 6 towers and relatively short distances, all the omnidirectional antennas work well. In fact, when we put the simulcast in and got it working, the ambulances that had to make transports from Pittsburgh, Pennsylvania hear the system real well down there. They've never been able to do that before, so the omnidirectional antennas are all we really needed at this point.

ED One last comment. Ellison Patterson?

ELLISON In an effort to reduce "noise" in the RF signal component we have had success in the utilization of PIM rated antennas. The low PIM (Passive InterModulation distortion) rating insures another round of quality control testing by insuring the joints soldered within the antenna radome are secure. Thus when the antenna is subjected to vibration, noise will not be generated, or any noise that may be generated is severely reduced.

We now only use 7/16" DIN connectors, rather than the typical type 'N' fittings at the base of the antenna. The 7/16" DIN has a better mechanical fit, and has a much higher RF power handling specification.